AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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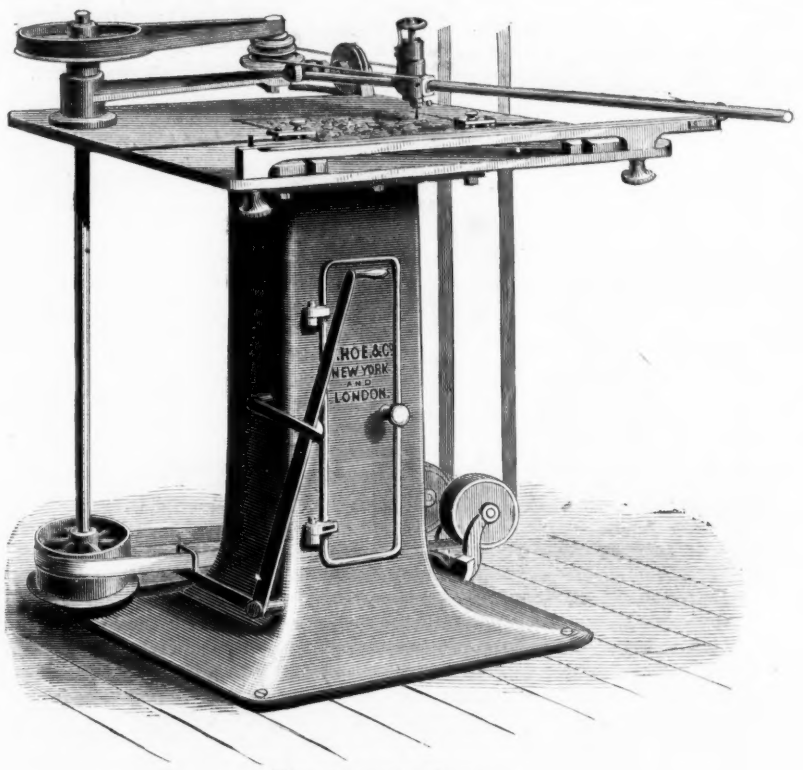
New Routing Machine.

In most kinds of business at the present day wood engravings have come to perform an important part. Correct ideas of a machine, or almost any other object or grouping of objects, are widely disseminated by means of printed cuts. The preparation of these cuts necessarily engages a great deal of skill. The representation of objects to be illustrated is first made upon a smooth block of boxwood, either with a pencil or by photography, then engraved. The wooden block is seldom used directly for printing as it is liable to be spoiled, but electrotyped or stereotyped plates in type metal are made from it at comparatively small expense. After these plates are cast the parts must be cut away where the imprint is to appear white. This is done by routing machines, a newly improved form of which is shown in the first illustration on this page. It is constructed entirely of iron, takes up but little room, and is so easily accessible on every side that the operator can work it without any trouble.

Power is communicated to the upright shaft in the corner of the table from below, and thence by pulleys and belts to the steel cutters, which revolve seven thousand times a minute, and which, by means of the double lever, can be brought to any point with ease and precision.

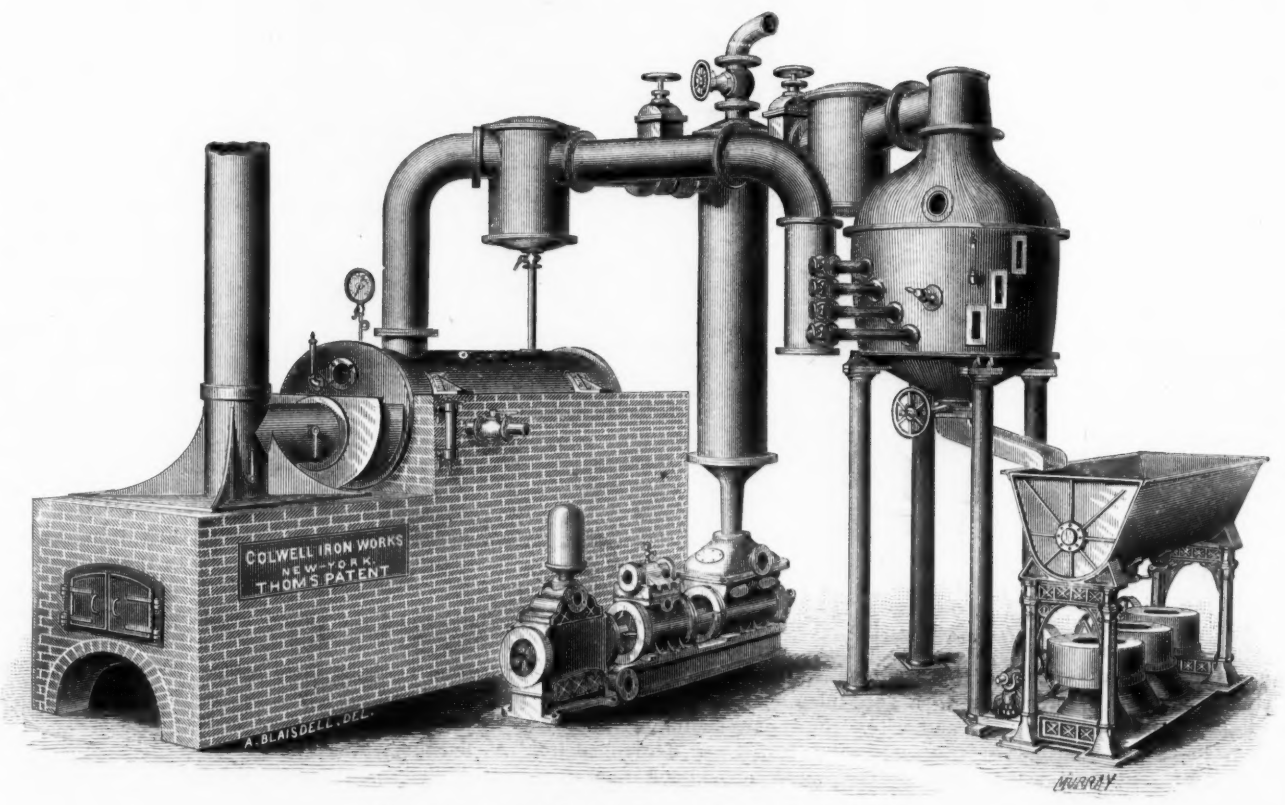
The machine also has a circular motion, and an arrangement for cutting straight lines. A spring rest prevents the tool from touching the plate till pressed down by the operator. The stand contains shelves for tools, reached by the door shown in the cut. This machine will work a plate 21×28 inches. The manufacturers are R. Hoe & Co., New York City, and London, England.



New Routing Machine.

Sorghum and Beet Sugar Machinery.

Within the last few years, stimulated largely by the untiring courage of our indefatigable Commissioner of Agriculture, General W. C. Le Duc, the farmers of the North and West have been awakened to the grand future before them and the country, in raising sugar from sorghum and beets. The Commissioner has found that certain species of cane can be grown with splendid results, as noticed in a previous issue, and the farmer has a new future opened to him. The one hundred million dollars going to purchase a year's supply of sugar in foreign countries can in part be spent at home, by raising sugar at home. The difficulty has not been to raise the cane but to get machinery that will do good work, for small farmers, at reasonable rates. One of the items of machinery that bears heavily in sugar production is the cost of steam-boilers, and their necessary care. To obviate this difficulty, the apparatus represented in the accompanying cut, was invented. It is the production of a gentleman who has a large experince in plantation machinery both in Cuba and Louisiana. He has operated in refineries, and knows the difficulties that inexperienced persons have to endure in working boilers. The brick work on the left contains a boiler, but instead of using it for water, and raising high pressure steam, defecated juice is placed in it and fire is applied by using the sorghum trash or bagasse, and the vapor that is raised passes over and boils the vacuum pan. The operation is just the same as the triple effect, also made by the Colwell Iron Works, New York City, but it is used by applying direct fire and working under vacuum.



Machinery for Making Sorghum and Beet Sugar.

There is no fear of explosion. As fast as the juice is made into syrup, it can be drawn off, reclarified, and sent to the vacuum pan, concentrated into crystal, discharged into the mixer, and purged in the centrifugal machines, as in the sugar pan, which, in fact, it is. The advantage of this combination is: to dispense with high pressure steam boilers, with their array of pipes and concomitants. The furnace is so arranged as to burn cane trash, and, by a system of dampers, the heat can be cut off entirely from the evaporation, and allowed to pass directly up the stack.

As for cleaning, a little acid-water will dissolve off the deposits. In Louisiana, where the plantations are located back from the river, this system is very valuable, for with Wason's saturator and mill, the bagasse can be used directly into the furnace, and no steam boilers needed, except to run the mill and centrifugal engine. To farmers planting sorghum, this combination is very desirable. It has been tried and found to work very satisfactorily.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * Thompson has printed at the top of his letter-heads "Positively no charges for boxing or cartage allowed," and Thompson almost always has written at the bottom of his bills: Boxing $1.00, cartage 25 cts. How's that for business? As near as I can remember back into the old time, there used to be some business understanding about packing, etc. If a product required boxing it was considered as a boxed article and no charge made, but if it did not require boxing, and a special requirement arose, then a special charge came in.

The panic years tipped the whole thing over. Long discounts were compensated for in a degree by extra charges of the sort mentioned. During the last few years manufacturers have been glad to get the even price of a box for a job. Now that things are sold for somewhere near their value it becomes of interest to know what to do with these little charges, which are vexations simply from a lack of uniformity in their treatment.

There are certain goods which cannot be shipped without boxing. Take a steam-engine governor for instance, or steam gauges, or general brass work or fittings, or small articles generally. You cannot put such things on a flat car and ship to any customer whatever. Shipping condition, in its narrowest sense, when applied to such articles, means boxed. A manufacturer or dealer engaged in such work can, to a certainty, calculate on boxing being an element of the cost in every case, and set his selling price accordingly. He may arrive at the figure by finding the cost of standard package for specific articles, or by adding a pro rata per centage as taken from the general expense account. I hold that with such goods, the packing being a certainty is always included in the price list. I would no more pay for boxing on such articles than I would pay for the paper and

twine on a codfish. I should assume that a grocer made his general expenses an element of his prices, and that the stated price settled for its delivery in deliverable shape.

If a man makes steam engines, or machine tools, or fabric machinery, or brick machines, or printing presses, or any such stuff, the case is different. Such stuff when slushed is in proper shipping order in eight cases out of ten. The price of such things is based on a cost which does not include boxing. It is always desirable to print the lowest prices and make special matters subject to change. Take a planer for instance. It stands in store doped with some wretched stuff to keep the rust off. To give this planer another coat of dope and ship it, is the usual thing. The doping being a constant expense has gone into the cost and has been charged for.

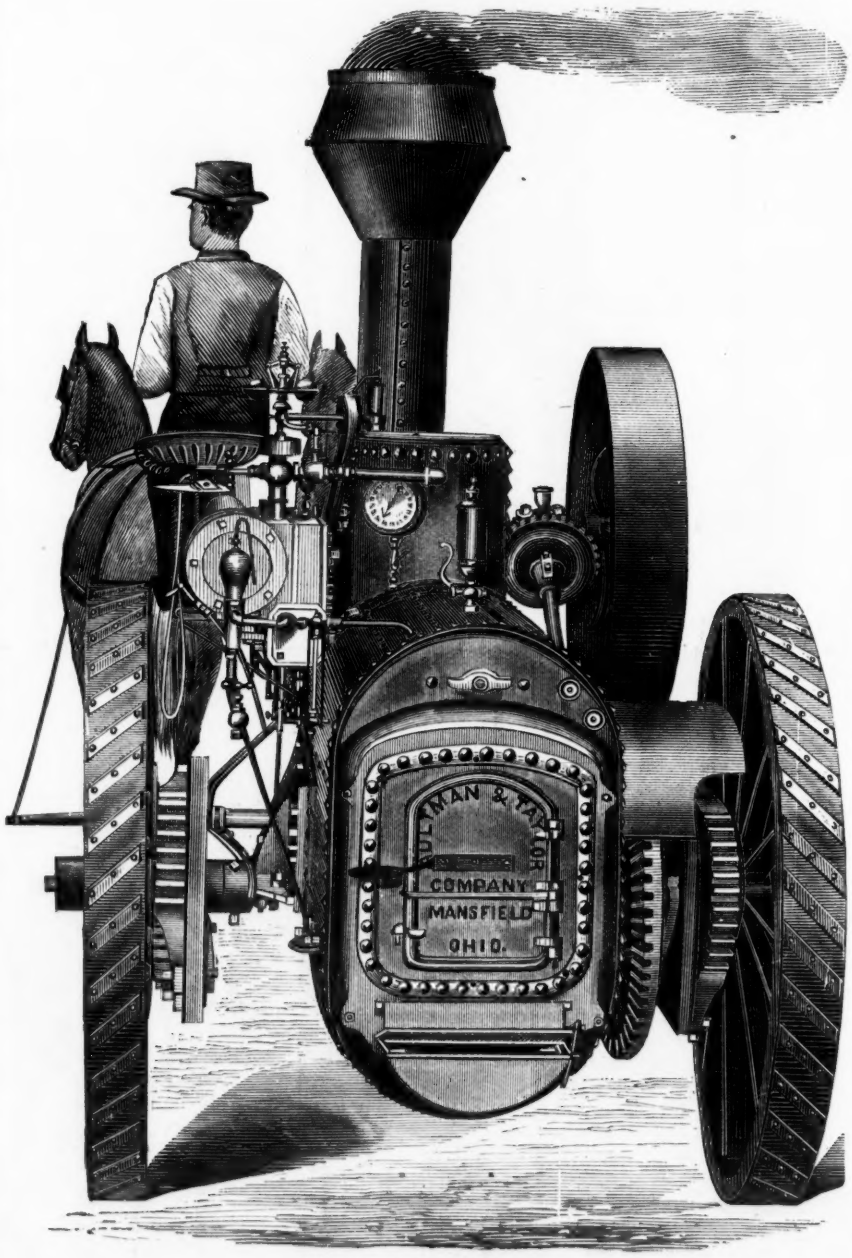
But some chap, who lives out in Montezuma, orders a planer, and says he lives two hundred miles from boat or rail, and orders the thing boxed in small pieces for wagon transportation. Parts to be extra slushed for a long journey and long delays, and boxing to be jolt proof. This planer has to be knocked down, slushed inside and outside, and every piece blocked in good shape. Every nice surface of unboxed pieces has to be well bound with protecting strips. With an ordinary-sized planer, here is an expense of not less than twenty-five dollars, which has not been included in the cost of the machine, and the Montezuma man ought to pay for it, not at cost only, but at the same rate as he pays for other work on the planer, that is, with a percentage of profit added. If this work is not included in the printed or quoted price, he gets it done and ought to pay. If it is included in the printed or quoted price, it is charging the greater number for work they do not order and do not get, and it loads a price list with a permanent contingency.

Again, railroad and boat classification of freight is such that, to certain points, the saving in freight, due to a change in class, will often more than pay for special boxing. Manufacturers have, as a general thing, nothing to do with freight charges on their product, and if twenty dollars are expended in special boxing, in order to save the consignee fifty dollars in freight charges, it seems that the consignee ought to pay the twenty dollars. If the shipper, in such a case, had to pay for this special boxing, he would be wise to let the stuff go unboxed, and pay the consignee the twenty dollars as a drawback. It would be less trouble and no more expense.

* * * * Cartage, to a manufacturer, is just as certain and definite a thing as office salaries or insurance. It is general expense, in nine cases out of ten, and a cartage item in a bill is a second charge for a thing already included. I don't believe in paying cartage from factory to cars under any ordinary circumstances of business.

* * * * My own idea has always been that a manufacturer should charge his product to somebody as soon as it is placed out of his hands, on board for instance; that a delivery on board means in condition for ordinary, usual, common transportation; and that any thing in the way of special expense should justify a special item in the bill. The matter is not at all trivial. On some classes of goods, the two items named can entail a loss or gain of ten per cent. to shipper or consignee.

* * * * Did you ever find, Mr. Editor, that a lack of elasticity on the part of your workmen thwarted you in your good intentions? Have you not found out that even American workmen get into a certain habit and kick vigorously against any change? This kick always takes the form of contempt for the man suggesting the change. If you have ever received such kicks you have also given them. This stubborn grooviness, this lack of the exercise of reason, this conservatism of craft is one thing present in some degree in all men, and its degree of absence represents the real degree of progress. A new foreman goes into a shop. He finds roughing cuts taken at a proper rate of feed but he finds that the quick finishing cut is unknown. No knowledge of tool surfacing by sliding cuts seems to exist. The wiry rough tapering and changing surface of the fine feed is the standard for rough work, and these defects corrected by the file are the standard for nicer work. A smart foreman bounces this thing instanter and he will have a hot time of it. He takes off his coat, grinds up broad nosed tools and shoves clean true cuts over work but there is no smile of approval. No workman meets him half way. The results are new and therefore unacceptable. This isn't always true but I am speaking of the many cases where it is true. There are several reasons why the men don't rebound to the new suggestion. For one reason they see a man claiming to show them something about their business. That hurts. For another reason they are called on to see and acknowledge that another man's process produces better results than their own. That hurts. For another reason it looks quicker. That hurts.



New Traction Engine.

* * * * Our new foreman, having full power, may, if he chooses, override the prejudices of his conservative workmen, and force them to a good plan by the simple exercise of authority. But if our new foreman is smart he will not do it that way, for he will be loosening the ground under him at the very start. He finds the men are good men and he is a poor general indeed if he starts out by putting indignities upon them. He would humble their pride, instead of enhancing it. If he takes the wrong tack he can very easily increase the cost of the work when the very opposite is his intention. If he gets one new man, an experienced broad tool man, he can make these chappies ashamed of themselves and effect the very object sought.

* * * * Such things come up every time a new foreman starts in. I have been on both sides of this business myself. I very well remember turning up a lot of circular saw arbors out of three inch cold rolled iron. They were about six feet long. Now, like every other country machinist, I had got it into my head that a saw arbor was a particularly nice job, and I also got it into my head that I could turn up a better one than the oldest man in America could.

To have a shaft so true that a sixty inch saw clamped between five inch collars should run dead true, seemed to be an essential quality in saw arbors, just as though it was not as easy and proper to make a hundred other things just as true. Of course it would not do to turn this job end for end after trueing one journal. The thought that this would apply equally as well to all journalled jobs never occurred to me. These arbors had a five-eighth key seat cut between the journals. I had turned up lots of these arbors. It was my special prerogative. I guess I got them all right and nice and true. They were not turned in the body at all. The collar work was fitted up and the journals skimmed, that was all. No filing, all water cut. Four inches projection beyond the outer journal allowed this whole thing to be finished at one dogging. From my lathe these arbors went to a planer and had the key seats cut. Now anybody who knows much about cold-rolled iron can imagine what became of my fine true journals and collar faces. But I never imagined anything about it, and the foreman never did.

But one day a new foreman came. Eddy was his name. I don't know whether he ever saw a saw arbor before or not, but he was a thorough mechanic and knew more about saw arbors in a minute than I did in a week. I didn't look at it that way however just then. He brought around some of these arbor jobs, looked at them a minute or two, bit his lip a little and then sent the jobs to the planer to have key seats cut in them before they went into the lathe.

I was in arms in a minute. This wasn't the way I had been doing the job. I claimed to have sense and reason and regard for people, but instead of co-operating with this man just when he needed it, and just when the co-operation of every man in the shop would be of real value to him, I grew morose, sullen, stubborn, defiant, and rebellious. I might state right here that Mr. Eddy showed a keen appreciation of these new and valuable qualities, and he proved it by giving the mutinous Chordal the grand and instantaneous "bounce." Eddy was a good mechanic, a good sort of a man, and all that, but he was a miserable general. He did not go and get one of my brag saw arbors in which the key seat had been planed after the lathe work was done. If he had he might have shown me my elegant arbor sprung about a thirty-second. No lecture would have been needed; I think I could have seen the joke without a diagram. Eddy's good sense told him that saw arbors should be straight, that turning the job nicely would straighten it, that keyseating would spring it, and that it would be a wise plan to do the crooking part of the business before the straightening part was done. He comes and orders me to plane the keyseated piece as straight as possible, and then do the lathe work. He didn't take the trouble to ease away my prejudices, so that I might be wiser and his path more smooth. He kicks one blockhead out and puts another blockhead in his place. It took me over two years to find out why Eddy changed the manner of making saw arbors, and during that two years I lived in ignorance, and he had my contempt. He failed in his obligations to his men, when he omitted to educate me, in some roundabout and unsuspicious manner, up to the new standard. A foreman should be a general, but a machinist is not a soldier. He is, or ought to be a skillful man. It should be: "know how to do," instead of "do this way." Eddy had no right to throw the burden of educating me in this special thing upon some other foreman. He had no right to let me pass through his fingers without my being wiser for having worked for him. He had no right to allow a mistaken contempt to rest in my mind. A workman has a claim on a foreman in the matter of the reason for certain operations of skill.

* * * * Very respectfully,

Chordal.

New Self-Propelling Traction Engine.

The illustration on this page represents a special design of portable engine, which is built by the Aultman and Taylor Company, of Mansfield, Ohio. This machine consists of a portable boiler, which is provided with a steam dome and is mounted upon wheels, and an engine, which is placed upon the top of the boiler. The latter is of the usual horizontal pattern, well proportioned, and simple in construction. The essential features of this machine are, that while it may be drawn by horses, it is also provided with a self-propelling device, which may by used to propel it independent of horses, also draw a loaded wagon after it. Power is communicated by means of bevel gears, and an inclined shaft, from the engine shaft to the main axle. In these connections the power is greatly multiplied, so that the whole machine is moved with comparative ease. Each of the large wheels is provided with a ratchet wheel, having catches, which enables the large wheels to adjust themselves to each other in turning a corner. This engine is fitted with all the necessary boiler appliances, and is well adapted to farm purposes.

One of our exchanges gravely informs its readers that Pittsburgh, Pa., and Newark, N. J., are both getting excited in regard to the quality of their water. The people of Pittsburgh drink "Monongahela" as a regular beverage. But why not get up a little excitement about the quality of the whiskey in some of our large cities? We more than suspect that it is chargeable with greater damage to health than the worst river or aqueduct water supplied to any town in the United States.

The New York longshoremen got more wages by striking, only three firms holding out against them.

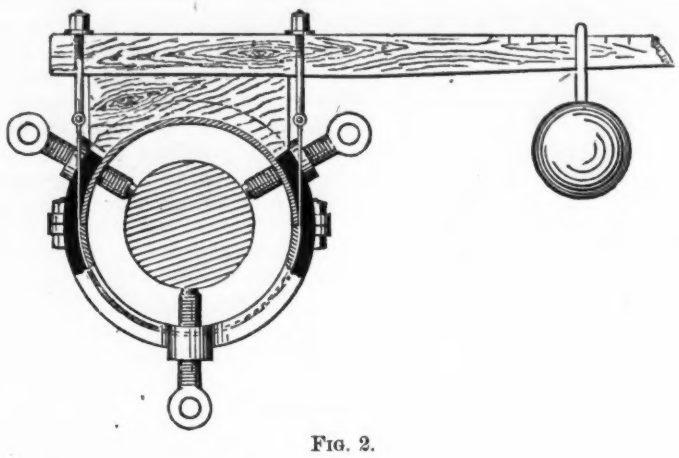


Fig. 2.

An Improved Form of the Dynamometer.

BY HERMAN T. C. KRAUS.

Conveniences for measuring the power required to run a certain machine, the actual horse-power developed by an engine in use, or the power in foot pounds which a belt is able to transmit, are totally lacking in most machine shops. In many shops, from lack of such conveniences, the ability even to apply them is wanting. A cheap and simple means of making these deductions enables the practical man to set all guess work aside, and to deal with facts.

In ascertaining the co-efficient of friction, valuable results are obtained by the use of the dynamometer or power measure. One of the simplest forms of this instrument is that illustrated in Fig. 1, and long known as the Prony Friction Brake.

In its construction two blocks of hard wood are fitted to a turned pulley. A lever is held on the upper block by bolts, which also clamp the blocks together and to the pulley. The end of this lever is arranged to receive weights; or a common spring balance will do as well.

The power absorbed by a certain machine, or the power transmitted by a belt is found approximately by multiplying the weight, or resistance, by the distance which the belt travels in a given time, and this by the velocity in the same time, and dividing this product by 33,000; the quotient thus gained is the horse power.

Example: To a driving shaft, or to any other shaft of a certain machine, a pulley is fixed (no matter what diameter). The shaft is required to make 60 revolutions for the duty it performs. The blocks are clamped together with the bolts, and have, by the friction thus produced, a tendency to swing around with the shaft, but this is prevented by placing weight on end of lever. This clamping of the blocks to pulley and putting up weights is continued, until the shaft makes 60 revolutions per minute, and we have for figures given: Length of lever, 3 feet; from center of shaft, describing, in swinging round, a diameter of 6 feet, a circumference of 3.14 multiplied by 6 = 18.84 feet, in one revolution. Weight of lever, outside of blocks, 6 lbs., and weight applied, 24 lbs.; 6 added to 24=30 lbs. in all, or in action; and in making one full revolution, 18.84 multiplied by 30=565.20 foot pounds per second; and in one minute, sixty times this result=33,912 foot pounds, which is, if a horse power is understood to be 33,000 lbs. raised one foot in one minute, 33,912 divided by 33,000=1,003 horse power.

The lever may be balanced by a fixed weight opposite, which is preferable, and may be marked like a scale beam for a single weight.

An improved form of this device is shown in Figs. 2 and 3, the latter being a back view of Fig. 2. This plan contemplates the use of one wooden block instead of two; instead of the lower block a strap of band iron is applied. The pulley is made in halves, and provided with long set screws for use with different sizes of shafts. By a little skill these are easily arranged to run through.

Soap water should be used for lubricating, so that heating can not take place. By the aid of a cord and pulleys, the device can be used in different positions.

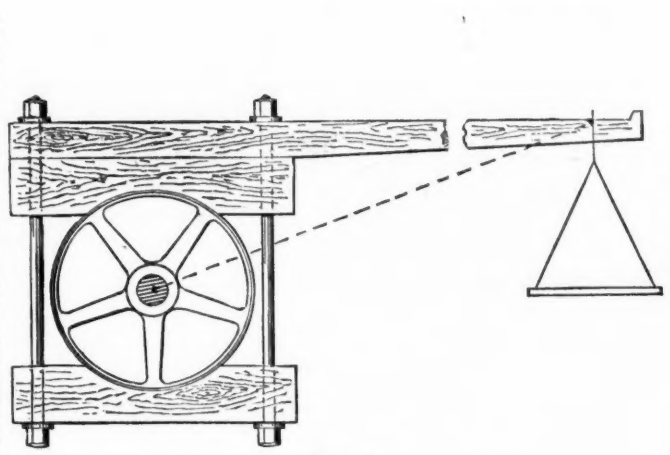


Fig. 1.

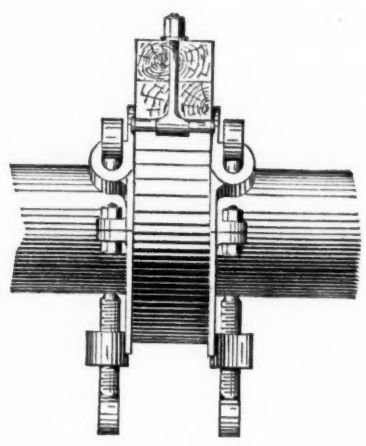


Fig. 3.

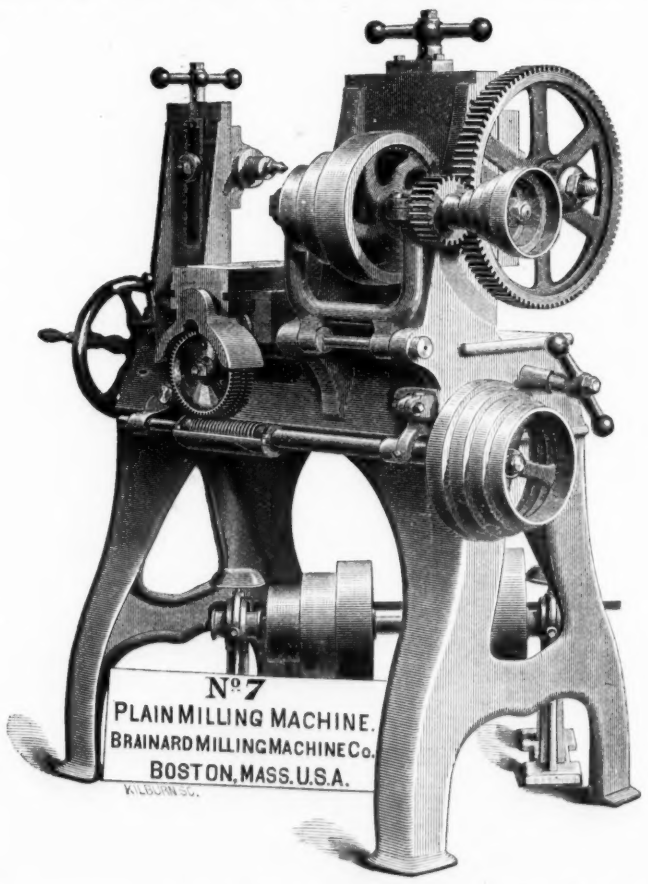
Equally with the user, such a plan as has been described is of use to the designer of any machine, enabling him to determine the strength required by any given part.

New Milling Machine.

The milling machine, herewith illustrated, is a recent production of the Brainard Milling Machine Co., Boston, and is intended to meet the requirements of gun and sewing machine manufacturers and all other parties using plain milling machines. The depth of bed is remarkable, and it is supported on substantial, wide reaching legs. The head is cast solid with the bed, and is heavily braced, not only above, but below the top of bed. The spindle is mounted on a heavy, square plate, having two tenons on its back, which move in guides on the head, to which it is rigidly held by four ¾-inch bolts. It is adjusted by a single screw, and has stop screw under spindle carrier.

This arrangement secures an exactness hardly possible in the old style of "plain" machines, where accuracy depends on the equal movement and wear of two screws and two gear-wheels. The spindle-gear is 16 inches in diameter, connected by a small pinion and a 3-pulley cone for 2½ inch belt. The driving gears are connected by a link, and are undisturbed by any changes in position of the spindle. The spindle is large, and is from dense hard steel, made expressly for the purpose. The feed-worm is of steel, and is kept constantly oiled by the device shown in cut. The automatic drop motion is an original device, positive in action and simple in design.

There are four changes of feed. A back-stand, with elevating screw and carrying a back-center to support outer end of mill arbor, is bolted to the bed.



The machine weighs about 1400 lbs. The automatic screw-feed is 13 inches; table 26 inches long; highest elevation of center from table, 8 inches. The distance between head and foot stand is 14½ inches. The speed of countershaft should be about 100 revolutions per minute.

Water Works Report.

We are indebted to Mr. Ira A. Holly, Superintendent of the Burlington, Iowa, Water Works, for a copy of his First Report (together with that of the Secretary) to the Burlington Water Company, covering the time from acceptance of Works, June 1st, 1878, to January 1st, 1880. These works are on what is called the "Holly System." There are 199 fire hydrants, 90 valves, and over 21 miles of mains and service pipes. The engines have run almost incessantly, day and night, since June 6th, 1878, having been stopped only 19½ hours in nineteen months, or an average of 1 minute and 56 seconds per day of 24 hours. Of this stoppage, 8 hours were for putting valves in mains, and the remaining 11½ hours were for the purpose of packing, filing brasses, etc., which is a creditable showing for new engines, where they are pumping against a pressure equal to a column of water 231 feet high. The amount charged, as expended for repairs on engines, pumps, boilers, etc., has been in the nineteen months, $3.55.

These works cost $190,000. The engine is of the compound type, and guaranteed to perform a duty equal to raising sixty million pounds of water one foot, with one hundred pounds of coal, and to supply the quantity of water—3,000,000 gallons daily, and throw the fire streams as required. It has four steam cylinders, each nineteen inches diameter, twenty-seven inch stroke, with four corresponding reciprocating pumps, each ten inches diameter and twenty-seven inch stroke, attached by direct connections, and erected on a heavy arched double frame of iron, set at an angle of 90 degrees, one steam cylinder and its pump being placed at each of the four corners.

The average fire pressure for the whole time is 130 lbs. to the square inch, the variation being from 115 to 150 lbs. at the extremes. The water works performed efficient service at 88 fires. The city consumed during the period named a daily average of over 271,000 gallons of water. The average consumption of coal was a little over one ton per day.

Boiler Inspections for January.

The Hartford Boiler Inspection and Insurance Company's report of inspections for January, 1880, shows a large increase of work done.

The summary of reports for the last month of 1879 was the largest ever exhibited in this country covering a like period previous to that time; but this one shows that nearly 200 more examinations were made than in December last, and about 9 per centum increase in the number of visits made. This indicates a very important increase in the company's business.

The whole number of inspection visits made during the month of January, 1880, was 1,687, and the total number of inspections made was 3,680, of which 1,224 were thorough annual internal inspections. The hydrostatic test was applied in 233 cases, in an auxiliary way mainly, to detect leaks in new and in repaired boilers.

The whole number of defects discovered during the month was 1,738; 361 of which were of so serious a character as to be considered dangerous at the moment of discovery, or would become so by the natural progress of deterioration before the time for the next inspection.

The defects were in detail as follows: Furnaces out of shape, 72—10 dangerous; 157 fractures—63 dangerous; 164 burned plates—39 dangerous; 309 blisters—29 dangerous; 211 cases of sediment and deposits—26 dangerous; 309 cases of incrustation and scale—28 dangerous; external corrosions, 96—38 dangerous; internal corrosions, 88—27 dangerous; internal grooving 15—1 dangerous; water gauges defective, 31—10 dangerous; blow-out apparatus defective, 30—19 dangerous; overloaded safety-valves 30—17 dangerous; pressure-gauges defective, 131—48 dangerous; boilers without pressure-gauges, 54; cases of deficiency of water, 12—5 dangerous; braces and stays broken, 29—1 dangerous; boilers condemned, 29.

A criminal in Russia is punished with the knout upon his bare back, and frequently goes into convulsions from the pain. Some of our worst tramps should be furnished with an knoutfit of this description, and banished from the country.

An Improved Boiler Setting.

The drawings of a 200 H. P. boiler on this page, and the one opposite, by Mr. W. H. Hoffman, are intended to illustrate the ideas expressed by Mr. H. in his articles on Boiler Proportion and Construction, which have appeared in the American Machinist.

The tube *opening* is sub-divided fifty-four times. The boiler has no steam dome, a liberal sized dry pipe being substituted for dome.

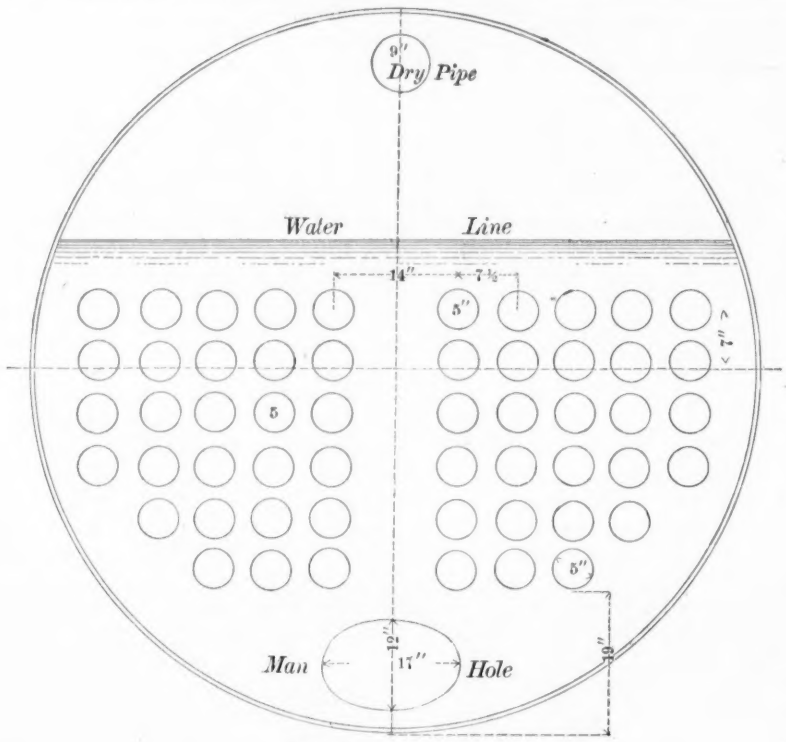
In the setting it will be noticed that there are *two* side walls on each side of the boiler, with an air space of 3″ between them. The bridge wall is hollow and wide, the space admitting a sufficient quantity of air to the combustion chamber, just behind the bridge wall, to ignite any of the escaping gases.

The heat after leaving the front end of the tubes passes over the top of boiler shell to main chimney flue, there being a thin layer of asbestos on the shell to protect it from any undue rise in temperature. It will be noticed that the brick work does not touch the boiler at any point, they being separated by thin cast iron plates.

The buck-staves are made of wrought channel iron instead of cast iron, with the flat face toward the brick work.

The double wall system will prevent cracking, and is a great source of economy as the air space becomes a perfect non-conductor.

Two doors are introduced in the fronts for convenience of attending to fires, but there is no partition in the furnace. The boiler can, by the peculiar method of arranging tubes, be thoroughly cleaned inside as well as outside.



Scale ½″ = 1 foot.

Letters from Practical Men.

THE SCREW-CUTTING PROBLEM AGAIN.

Editor American Machinist:

Without occupying your valuable space with much explanation of the process, let me offer a solution of your correspondent's "Problem in Screw-Cutting," in your issue of the 13th ult:

1⅛″ pitch is ⅝ threads to the inch; then 5 is to ⅝ as 45 is to 8. The product of the drivers must be to that of the driven in the above ratio. We multiply both terms of the ratio by any numbers we choose—say, 10 and 12; then $45\times10\times12$ is to $8\times10\times12$ as 5400 is to 960. We resolve these terms into two factors each, which will give us the gears required: $90\times60:32\times30$. 90 and 60 will be the drivers, 32 and 30 will be the driven.

Let me suggest another "problem:" The meter equals 39.37 inches. (It will be handy to remember the length of the meter if we call it 3 feet, 3 inches, and 3 eighths, which is less than a two-hundredth of an inch out of the way.) By what contrivance may a screw of one centimeter pitch be cut upon a common screw-cutting engine lathe?

Frank H. Richards.

Springfield, Mass.

Editor American Machinist:

I notice in this week's issue, March 13, a problem in screw cutting by C. A. Hague. Required compound gearing to cut a thread for 1½″ pitch; the feed screw of lathe being 5 threads to the inch.

I find there should be 8 threads in 9 inches on screw to be cut. And there are 45 threads on the same number of inches on leading screw, therefore I use those numbers 8 and 45 to represent thread to be cut, and leading screws instead 1½ pitch and 5 to inch.

Pick up 3 gears and calculate to find the 4th gear. Thus, take 90 for 1st driver, or spindle, 40 for 1st driven, in contact with gear on spindle or 1st driver, 70 for 2nd driver on same stud as 40. Then multiply the thread to be cut, 8, by the 1st driver, also by the 2nd driver thus:

$$8\times90\times70=50400.$$

Multiply the 1st driven gear, 40 by the number of threads on leading screw, 45, thus:

$$40\times45=1800.$$

Use the 1800 for a divisor, and 50400 for a dividend:

1800) 50400 (28 teeth in gear on
36

144
144

leading screw.

Thread to be cut, 8. First driver, 90. First driven, 40. Second driver, 70. Second driven, 28. Leading screw, 45. Or, 1½ pitch, 5 threads to the inch. Some lathes that are geared by 5s and 10s, I mean 20, 25, 30 and so on, don't usually have a 28 gear; the calculation can then he made by substituting 30 for 28, also 75 instead of 70.

2nd. The rule I use for calculating would then be

$$\frac{8\times90\times75}{40\times45}=\frac{54000}{1800}=30$$

Multiply the thread to be cut by the 1st, and also by the 2nd driver.

Also multiply the 1st driven by the number of threads in leading screws. Divide the first product by the second; the answer will be the number of teeth in gear on leading screw. Respectfully yours,

Peter Falconer.

Jersey City.

THEORY OF HARDENING STEEL.

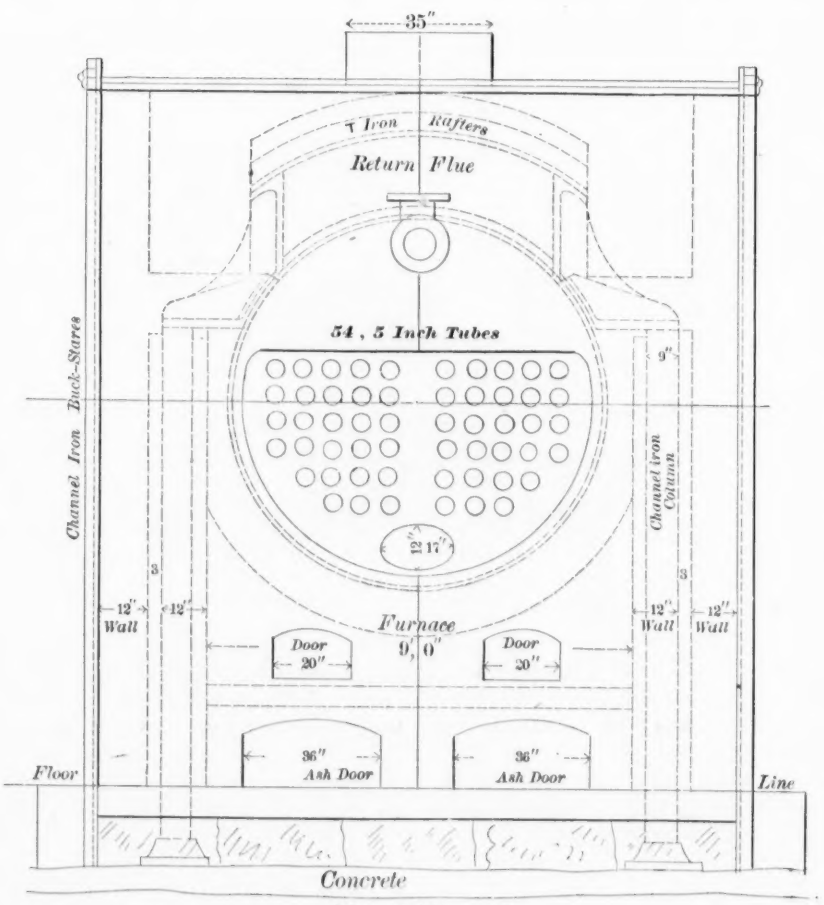
Editor American Machinist:

In the "Questions and Answers" department of your paper of February 7th, S. M., of Winchester, Ill., says: "If we want to harden one piece of steel, and soften another piece, we heat them both to a red heat; the one we wish to soften we cool slowly, and the one we wish to harden we cool suddenly. Why does it harden?" So far, I observe, no one has attempted a reply. I am neither a mechanic nor a chemist—simply a lawyer—but I have an opinion on the matter inquired about, and am willing, with your consent, to give it to your readers, free of charge. Here it is: Iron is converted into steel, that is, made harder, by putting more carbon in it. If we wish to make it still harder, what will we do? Would not the reasonable way be to put still more carbon in it? Both charcoal and "stone coal" are composed largely of carbon. When ignited and suddenly consumed (as we call it) the carbon is rapidly released. A piece of steel thrust into a hot fire of either of the coals mentioned will suddenly expand. The openings between the molecules are enlarged, and the carbon escaping from the rapidly burning coal is taken up by these openings (or "pores") faster than the carbon in the steel escapes. By the time it reaches a good, red heat it contains more carbon than when put into the fire. Thrust it into cold water, or otherwise cool it suddenly, and this additonal carbon, or the larger part thereof, will be retained, and the steel made harder. By permitting it to cool slowly not only the additional carbon put in by the heating process, but also some of that which it contained before, escapes and it is made softer.

I only suggest this as possibly a correct answer to S. M's question. Very truly,

Jas. M. Riggs.

Winchester, Ill.



Front Elevation

THEORY AND PRACTICE.

Editor American Machinist:

Very common are the instances of ignorance of practical men as related by your correspondent Charles A. Hague. I once saw a chap of that kind put the feed-pipe from a boiler into the exhaust pipe of an engine. He was employed to erect, and much to the disgust of the practical man, it would not work. Hundreds of queer blunders are made with all kinds of machinery, but the practical man is innocent in comparison with the learned M.E's, who have talked into his ears the notion of the expansive force of *dead* steam, *i.e.*, steam that has been *severed from its connection with the boiler*—for instance, steam that has been cut off at ¼ or ¾ stroke in a cylinder. Were it not for the momentum of the engine the moment the steam was *cut off* the machine would stop. As in the dead weight steam hammer—just look over the records of the Patent Office and see the abortive articles labeled "cut-off."

If the theoretical man is asked if an ordinary steam engine would run with the stop-valves closed, and steam introduced into the cylinder through the cylinder drip-cocks, he would, of course, answer "no," but the practical man would say "yes."

H. C. Hill.

Norristown, Pa.

How Pig Iron is Made.

(*Concluded.*)

BY WM. J. WILLIAMS.

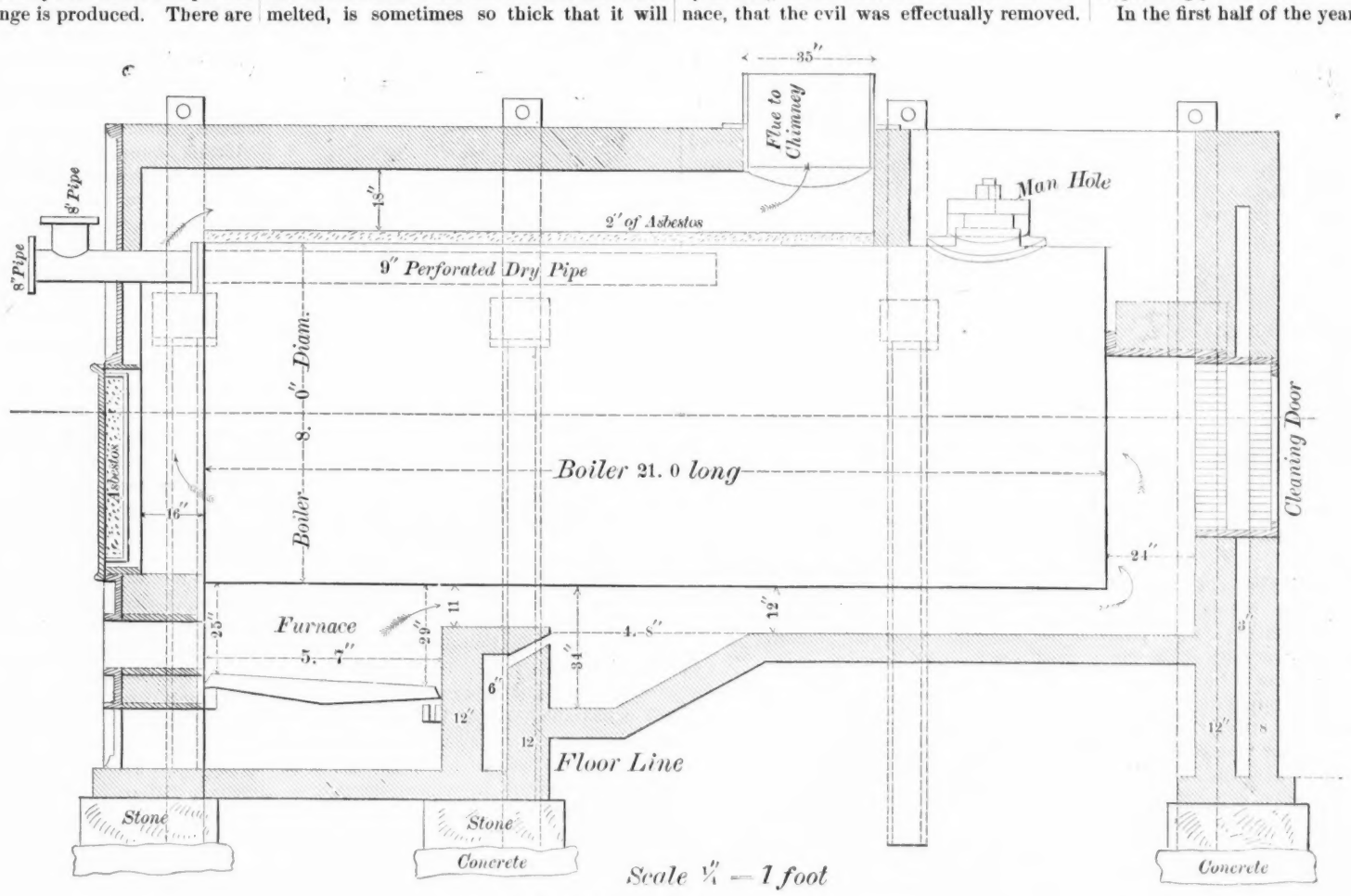
Opposite that side of a furnace and joining it, containing the *working* arch, is a building called the *cast house*, the floor of which is covered with a coarse sort of moulding sand. A wooden pattern of a "pig" of iron is used to make the moulds for the iron to run into. At right angles with the pig moulds is a gutter, called the *sow;* a series of "pig" beds are made, and when the first bed is full, a little sand is thrown into the sow to prevent its further passage that way. At the same time the passage to the next sow is opened to allow the metal to flow into the next pig bed, and so on, until all the iron has been drawn off. This is called a *casting*, and may be made once in 6, 8, or 12 hours, according to requirements of furnace.

A "pig" of iron weighs about 100 lbs. During the casting, the *sows* and *pigs* are joined together, while they are yet in a molten state. A little sand is strewn over them to prevent their cooling too quick, and to give the workmen time to perform other duties before the "pigs" are broken from the sows. The cinder is drawn off about every three-fourths of an hour, if the furnace is working properly, which is called *flushing;* it is run off over the *fall* into pits having a piece of iron inserted in the middle of each pit, and extending above the surface of cinder when the pits are full, for the purpose of fastening a chain to them to be lifted by a crane into the *cinder cart* to be taken to the *cinder heap*. At some convenient time the lumps are broken and the irons used again.

Before a furnace is filled with *stock* (coal, iron ore, limestone, and rolling mill cinder,) it is first thoroughly dried, by having a slow wood fire made within it. When sufficiently dry, the following quantities of wood and coal were used as kindling at the blowing in of a furnace nearly 60 feet high: first, seven cords of wood; on this were placed twenty

tons coal; then to fill the furnace with stock required more than five hundred tons of iron ore, coal and limestone, laid on in successive layers. As soon as the necessary preparations were made fire was applied to the cord wood, and in less than ten minutes smoke was seen issuing from the top, and in twenty-four hours more the furnace was ready for the blast, and commenced to make iron. In a few hours the hearth fills with metal and cinder; the latter protects the former from being oxidized or burned up.

The color and condition of the cinder when drawn off, indicate the success of the operation; if dark and heavy, it contains metal; if it has a dark, vitreous appearance with streaks of green, some oxide of iron has been carried off. The proportion of coal and fluxes is regulated to suit the kind of ore that is being reduced. Sometimes corrections can be made by increasing or diminishing the amount of blast; but, if it cannot be accomplished in this manner, then the proportions of stock have to be changed. This is called *changing the burden;* as it is introduced at the top of furnace it will take from two to three days to reach that part of it where the change is produced. There are



Side Sectional view

six different brands of "pig" iron known to the market, viz.: Nos. 1, 2, and 3, foundry iron, and Nos. 1, 2, and 3, "forge iron." The latter are also known as "grey forge," "mottled," and "white" iron.

No. 1 foundry differs in its chemical composition, by its containing more carbon than any of the other brands; it is said to be combined with as much carbon as the iron is capable of holding. It is soft, and when melted is very fluid, and capable of running into the finest moulding. As it expands while cooling, it thereby perfectly adapts itself to the most delicate moulds. The surface of "pigs" presents a very smooth appearance. When broken, it does not ring, but has rather a dead, dull sound. The fracture exhibits a large, dark, bright open grain, with dead spots of lighter color.

When very highly carbonized, the "pigs" are often covered with a substance, called by the workmen *kish*, which is a carburet of iron, or graphite, and indicates an excess of carbon in the "pig." No. 2 is less carbonized, is not so soft, the grain is closer, and fracture more regular; when melted, it is not so fluid, nor is the surface of "pig" so smooth as No. 1, but it is harder and stronger, is more suitable for general castings of machinery where strength and durability are desired. No. 3 is closer grained, more regular, and darker when broken than No. 2, is very strong, and possesses considerable toughness. Being harder, it is more suitable for castings where great strength and resistance to wear are sought to be obtained; it contains less carbon than No. 2. "Grey forge" also possesses the quality of expanding while cooling, and is therefore suitable for some kinds of castings, but is not fluid enough, when melted, to fill any intricate moulds. In some respects, it is similar to No. 1 foundry, being combined with carbon and partly graphitic; its fracture is a lighter color, and its lustre is brighter than those before described. Considerable quantities of *kish* are sometimes found about the working arch of a furnace, when this brand is being made. Grey forge is generally used for making wrought iron.

"Mottled iron," or No. 2 forge, is used exclusively for making wrought iron. Its fracture is smooth, with scarcely any grain; it is spotted or mottled with white and grey, and is totally unfit for castings, from the fact that it shrinks while cooling.

"White iron," or No. 3 forge, contains the least carbon of all the brands, and when melted, is sometimes so thick that it will hardly run, when it is said to be *raw;* it is very brittle and hard. Its fracture is a silvery white, its texture is smooth and shining, its structure being foliated or crystallized. It also contracts while cooling, and is, therefore, unfit for castings. All of these may be made from the same kind of iron ore. Each brand requires a different *burden;* this, in some cases, can be effected by a different working of the furnace, but it is not uncommon to get a brand of iron at a casting different from a previous one. For instance, it is required to make No. 1 foundry, but, through some cause, it has changed to No. 2; or, if "grey forge" is required, "mottled" or "white" may be produced. Often a kind is produced which seems to be neither, or, rather, a mixture of all three, but the practical metallurgist soon corrects it, although at times it may take a day or two, while a few hours may suffice.

Causes and effects are, perhaps, nowhere more exemplified than in a blast furnace. It requires great skill, sound judgment, and years of practical experience, to make such undertakings a financial success. A blast furnace in operation is a great chemical workshop, and, from the inaccessibility of its interior, must forever remain an unsolved problem as to what takes place within. Huge volumes of gases are thrown off, some of which the practiced eye can call by name, others we do not see, while the effects produced on persons differ.

An instance is related of an employe being affected as if he had taken laughing gas; now he would laugh, at another time cry, and at other times he would be pugnacious. Conditions sometimes occur in and about a blast furnace calculated to baffle the judgment of the best of managers to the extent, even, of being under the disagreeable necessity of *blowing out*, and, as it were, beginning again; in fact, it is a good place for others besides the manager to do some *thinking* in.

Iron manufacturers are indebted to Mr. J. B. Neilson, a civil engineer, and, at the time (1824), manager of the Glasgow Gas Works, when his attention was directed to blast furnaces. Inquiries had been made of him whether he could not purify the air before it was blown into the furnaces, in some way similar to purifying gas. After some experiments, he came to the conclusion that something more than supposed impurities was the cause of their trouble. He found by heating the air before it entered the furnace, that the evil was effectually removed.

Prior to, and during the first half of the year 1829, all furnaces used cold blast, and required, as at the Clyde iron works in Scotland, 8 tons, 1¼ cwt. of bituminous coal, previously coked, to produce one ton of cast iron. In the corresponding period of the year 1830, the blast was heated to a temperature of 300° Fah., and, during this period, 5 tons, 3¼ cwt. of coal converted into coke, were required to produce 1 ton of iron. In the first half of the year 1833 only 2 tons, 5¼ cwt. of coal, not converted into coke, smelted 1 ton of cast iron.

These were the results from three furnaces worked by the company, and blown by the same engine and same blowing tub. The blowing engine had a cylinder of 40 inches diameter; the tub's diameter was 80 inches, with 8 feet stroke and a speed of 18 strokes per minute. By a simple calculation the quantity of air forced into the three furnaces in a given time can, at least, be approximated. Thus one will be able to see how a less quantity of fuel necessary to produce a ton of cast iron was brought about, and where the iron manufacturer's difficulties came from in the early days. Such a blowing tub piston as has been described, would displace at each stroke 279 cubic feet, or in one minute, 5025 cubic feet. This amount of air at the earth's surface will weigh 402 lbs.; one hour's work of piston would amount to 24,120 lbs. If one half of this only reached the furnaces, through defects of machinery and unavoidable losses, there would still be left 6 net tons of air, of whatever temperature it might happen to be, pumped into the three furnaces, or two tons to each. Now it is a well-known fact, that air will not support combustion if its temperature is less than 1000° Fah. The refrigerating effect of so large a quantity as shown may be judged, when it is noted that its temperature during a great part of the time was perhaps not a great deal above the freezing point.

In these days the temperature of blast used is often 1000° Fah., while 1500° have been attained; but from 700° to 800° is about the average. With the latter a ton of grey forge cast iron can be produced with 1 ton, 10 cwt. of anthracite coal. Furnaces of former days seldom exceeded 35 feet in height, and required larger steam cylinders than would be used for the same size furnaces in these high-pressure steam times. Now the height of a furnace is seldom less than 50 feet, and often more, the capacity to produce iron being correspondingly increased.

In the first half of the year 1833, when the heat of blast was 600°, the weekly product of the Clyde furnaces was 245 tons; to-day one furnace of 55 feet should produce this amount of No. 1 forge iron, and would be supplied with a blowing engine with steam cylinder from 30 to 40 inches diameter, and blowing tub of 90 inches by, perhaps, 6 feet stroke, making, at times, 18 revolutions per minute. This would at this speed and stroke displace 9,540 cubic feet of air per minute, or 45,990 lbs. per hour. If the same allowance for losses and imperfections be made, as for the Clyde furnaces, there would still be left, as possibly entering the furnace, nearly 11½ net tons of air per hour.

As in all smelting operations, quantity and quality must be somewhat dependent on the character of the ores operated on. The quantity of iron that any furnace can smelt depends also on the quality to be made: No. 1 foundry being the least, and No. 2 foundry being less than No. 3. Of the forge irons, grey forge is the least. "Mottled iron" yields more, and "white iron" the most of all. The poorer the quality, the greater the production.

The beet sugar boom is on the advance in Madison County, N. Y., hop growers there intending to change their hop fields into beet fields, as a more profitable crop.

Practical Blacksmithing—Blowers.

BY FREDERICK LEWIS.

The blowers in use at the present day, though made in numerous different ways and sold under different names, embrace but two principles, viz.: the fan blast, and the positive blast. When first invented, the fan consisted of two arms or blades, to which others were subsequently added, until, at the present day, the best fan blower has eight arms, to which are attached the same number of blades. The original fan blower was rude in construction, the parts unbalanced, and, in consequence, made a great deal of noise while running. The bearings on the shaft wore irregularly, and were soon destroyed. The illustration, Fig. 1, represents an improved pressure fan blower, for ordinary pressures, such as is required in blacksmith shops. Another pattern, more strongly built, is shown in Fig. 2. This blower is used where greater pressures are required, as for cupolas and furnaces. It is similar to Fig. 1, only the parts are smaller and stronger. These blowers are so constructed, and so nicely balanced, that, while running at a speed from 2,000 to 5,000 revolutions per minute, they produce very little, if any, noise. The journals are made self-oiling, and are also adjustable, as the parts become

FIG. 1.

worn. This blower produces a steady, uninterrupted blast.

An improved form of blower, for producing the positive blast, is shown in Fig. 3. The principle of a positive blast is very ancient, and, like the fan blower, has also passed through many stages of improvement. The positive blast was referred to in my first article on Blacksmithing, the principles of which had its origin in the human lungs.

In my first article I advocated the use of the old fashioned leather bellows, for the reason that it gives a positive pulsative blast. I have found, not only in my own experience, but also that the oldest blacksmiths concur with me, that the bellows mentioned produces the most effective blast.

The blower Fig. 3, for producing the positive blast, embodies the same principles as the bellows referred to, the power of the blast being increased and the pulsations more rapid.

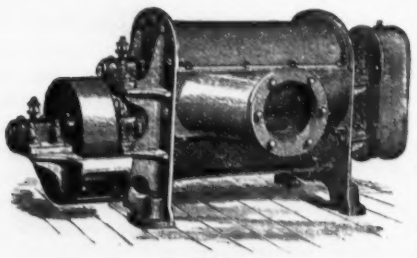


FIG. 3.

A certain trial was made a few years since, between a fan and a positive blower, which were similar in construction to those shown in the accompanying illustrations. The results were, that the fan blower required a speed of 1920 revolutions per minute, and an expenditure of 13 H. P., while the positive blast required a speed of 83 revolutions per minute, and 8.6 H. P. to do the same amount of work, and in less time.

The blower shown in Fig. 3 is driven by one belt and consists of a cast iron shell, inside of which are placed two cast iron revolvers, as shown in Fig. 4, which represents a sectional view of Fig. 3. Each of these revolvers is equally balanced, and as they revolve at a uniform speed there is no tendency to cause a jumping motion which would wear the journals irregularly. These revolvers have no bolts or wood about them which cause unnecessary friction and get out of order, besides the revolvers do not return any of the air, which is received and compressed.

The noise made by these blowers, when in operation, is almost, if not entirely, overcome.

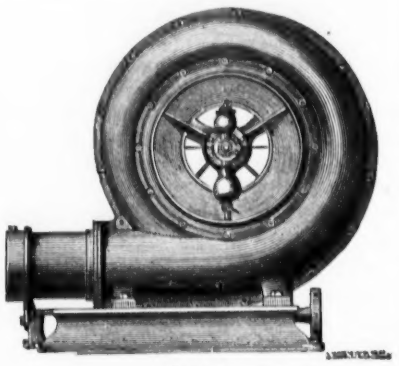


FIG. 2.

This blower, unlike the fan, displaces a certain amount of air at each revolution, or in other words, as the revolvers pass the opening in the shell, the air enclosed is pushed forward, until it is forced into the blast pipe, on the opposite side. This positive movement, necessitates putting a safety valve upon the blower or pipe, otherwise, when the mouths of the pipes are closed, the blower must necessarily stop, while with the fan blower the pipes may all be closed, and yet the fan may be run at about the same speed as before, thus showing, that, while no air passes forward into the pipe it is simply beaten about in the case. The pulsations produced by the positive blast have this advantage, that while they are so rapid, as to be scarcely perceptible, they agitate the fire, and by constantly shaking it, make it more dense, producing a better combustion and consequently greater heat. The approximation to a perfect combustion depends upon the constant supply of a certain amount of air, and at a given pressure. A high pressure is not necessary to secure a perfect com-

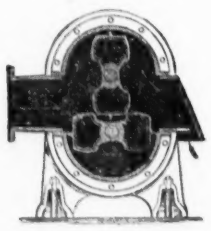


FIG. 4.

bustion, and a too low pressure is equally objectionable. The fan blower produces a steady monotonous blast which will blow a hole through a fire, and does not agitate the fire, or vary the blast, which features have been found so desirable in working a fire.

Hon. Carroll D. Wright, Chief of the State Bureau of Statistics, says he knows it to be a fact that there are in Massachusetts to-day paid agents of the manufacturers of old England to create strikes in New England.

A wheelbarrow that can be folded in a flat package by simply removing two nuts and a bolt has been invented by a Syracuse man. It has the important advantage that when not in use it can be stored in some place where everybody will not be falling over it.

The State of Maine pays a bonus of $7000 a year to the only beet sugar factory within its borders.

The beet sugar factory at Wilmington, Del., is putting in new machinery so as to enlarge its capacity to 100 tons a day.

The employes of the Bridgeton, N. J., nail works have had their wages advanced.

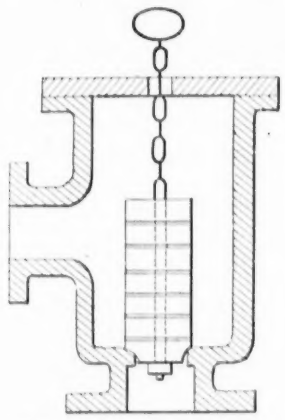
Lever Safety-Valves.

BY W. BARNET LE VAN.

The common lever safety-valve, as illustrated in the former article, was invented by a Frenchman, Denys Papin, who was born in Blois, in France; a physician and philosopher, and one of the most talented of the early experimenters on steam and air; a man of whom any country might have been proud. France cast him out as a disgrace, on account of his religion, at the revocation of the edict of Nantes by Louis XIV., and now claims honor to herself for having given him birth, and mourns that the records of his labors are only found in foreign archives.

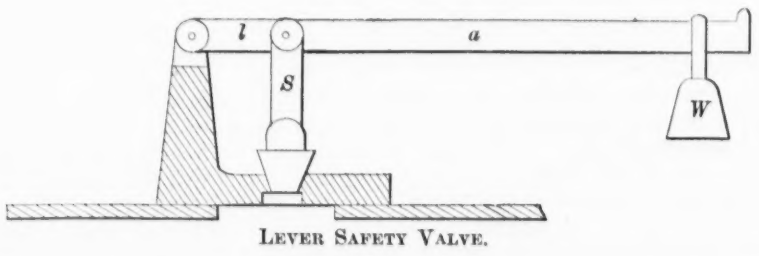
Through the influence of the celebrated Boyle, whom he assisted in his experiments with the air pump, Papin was elected a fellow of the British Royal Society in December, 1680. He was an active and useful member, and contributed several interesting papers to the Society's Transactions. In 1681 he invented a method of softening bones, with a view to extract nourishing food from them; namely, by submitting them to the action of steam at high temperatures (pressure) in close vessels, named *digesters*.

Papin's first digesters were liable to be



POSITIVE SAFETY VALVE.

rent asunder by the high pressure of steam accumulating in them when in place on the fire with their orifices stopped. They are shown in detail in Poliniere's *Experience de Physique*, 2nd edition, Paris, 1718. Each consisted of a short, but very thick tube of bell metal, about a foot in length and five inches in diameter, with one end closed. The open end had a collar cast on it, to which the cap or cover was secured by clamps and a screw. The cover and end of the tube were ground together so as to fit air-tight, like a valve to its seat. A few bones and a little water were put in, and the cover screwed down; the vessel was then laid in a horizontal position on a bed of charcoal in a long iron grate. The almost unavoidable rupture of these vessels led Papin to the invention of the common lever safety-valve, which he first applied to them, and afterwards to machines for raising water by steam.



LEVER SAFETY VALVE.

Papin's claim, therefore, relates not to the valve itself, but to its improvement, or rather to the mode of applying it by means of a lever and movable weight; thereby not only preventing the valve from being blown entirely out of its place, but regulating the pressure at will, and rendering the device of universal application.

It consisted of a conical valve retained in its seat by a weight on a lever, and from its resemblance to a steel-yard was originally called the *Steel-yard Safety-Valve*, being a solid cone seated on the boiler plate, and acted on by a weighted lever.

More than three thousand years ago Solomon with all his wisdom declared that there was nothing new under the sun; and to-day perhaps nothing is more difficult than to be entirely original.

Watt's Safety Valve, A.D. 1800, was a disk acted on by a series of direct weights, and a chain-handle connecting to the valve-rod above the weights to raise them and the valve.

Address to Syracuse Board of Trade.

Prof. John E. Sweet recently delivered an excellent address on manufacturing and training mechanics, at a meeting of the Syracuse, N.Y., Board of Trade, which was thereupon ordered to be printed, and from which we make the following extracts. Prof. Sweet took the lead in starting an Engineers Society in Syracuse last winter, and, together with other public spirited citizens is now taking steps to found a technical institute in that city:

A mercantile house may flourish with a single man at the head having business capacity.

But no manufacturing establishment can succeed by business management alone. Every mechanical works of any magnitude must have a mechanic somewhere about. Either the head working in harmony with the business head, or, as is very seldom the case, both the mechanic and the business manager centered in one man.

If this be true it stands the business man in hand, before embarking in a manufacturing business, to measure the capacity of the man who is to run the machine; and so long as we are deficient in men of the right stamp for filling these places our manufactures must languish. So long as we have business men embarking in mechanical enterprises, thoughtless as to the ability and character of the mechanic or ignoring his importance, so long shall we have iron works to fail, wind-mill works to go down, woolen-mills to go up, and mowing-machine shops to fade into the forgotten past.

To increase our manufacturing we must not only increase the ability of our mechanics, but must at the same time raise their business standing.

If our recently formed Mechanical Association and a Technical School now in contemplation be sustained they will surely do the one; and it lies with the business men of the city to do the other. When you are ready to maintain that the greasy mechanic with skill, and intellect, and usefulness shall stand upon a level with other men of whatever calling who are only their equal in skill, intellect and usefulness, then you will raise up a class of mechanics equal to any emergency.

A word now about the technical school.

Before starting a new enterprise it is well to inquire whether there is any demand for the goods. You are aware that mechanics can not be made without training any more than lawyers or doctors. If it is admitted that the state has a right to train the rich man's sons to be doctors and lawyers and teachers, it has an equal right to train the poor man's sons to be masons, carpenters and machinists. But it does not do it.

The old apprentice system has almost completely gone out of vogue, and if there are to be a class of men to take the place of those who have almost worn themselves out hammering other people's iron, something must be done to start the boys of to-day on the right road.

While the present technical branches of our Universities are doing something in the way of supplying the place of the apprentice system they fail to reach a certain class and that class is the most desirable to reach—the sons of the working mechanic.

The cost of a regular University course is from one thousand to three thousand dollars and but few of our working mechanics can give even one of their sons the advantage of such a schooling and besides there is a good deal of lottery about it, for, as is well known, but one out of every four or five ever profits by it to any great extent.

I am fully convinced that the most efficient method is to combine the instruction with actual work, and if enough work can be had so the student can earn day-times enough to pay for the instruction he receives nights, then the poor man's sons can have a chance—not a fair chance, for the State would give no aid to such a school, and rich men who endow colleges only put their money where it will bring them glory.

We hope to start a school in which our own and other apprentices can receive instruction in mathematics, drawing and mechanics, with some drill in the other essential things that go to make a good mechanic.

The same trouble exists and the same difficulties will have to be overcome that work against our present apprenticeship system.

The fact is, it costs just as much to teach a boy to be a machinist as it does to teach him anything else. And the reason boys can not get places in a machine shop is because it does not pay to have them about.

If you want your sons schooled in a machine shop (or engineering establishment—to give the matter some dignity) pay the price you would expect to in other schools, and there will be no trouble.

If we ever raise Syracuse to the position her location and surroundings would justify her in holding, we must produce goods that will equal the best work in the country.

To do that every mechanical department must have a mechanic at its head.

If we have not enough of the right stamp, those whom we have must make themselves equal to the demand, or give way to others who are.

If we are to have competent mechanics twenty years hence, we must begin now to make them.

How few realize that mechanics underlie nine-tenths of all human industries, and that the other tenth is dependent upon it! What could be done without tools?

James Freeman Clarke says, "man is the only tool-making animal," and he uses that fact as an argument against the Darwinian theory.

But I think the world has more to be thankful for to the tool-makers than simply that of furnishing an argument against Darwin.

Blot out of existence to-day one single tool, and that the most simple of all, the hammer (with the other tools working on the same principle) and civilization would not only go back to barbarism, but what there would be left of mankind at the end of the recession, would be dwelling in caves, and living on nuts, and roots, and snails.

The fearful force residing in a body revolving at a rate of 500 revolutions per minute was recently illustrated at the works of the Medart Patent Pulley Company. A grind stone measuring five feet in diameter, and making 500 revolutions per minute, suddenly broke. The force with which the pieces were driven off in straight lines was so great as to tear out a gap in an eight inch brick wall about four feet in diameter. Another piece taking an upward direction, struck the floor above, tearing up several square yards of heavy ash flooring. This is the second large stone that has broken recently. The speed required to execute the work is so high that an ordinary stone cannot maintain its form. Itacolumite wheels have been substituted, and are found to give unquestionable satisfaction.—*St. Louis Journal of Commerce.*

Details of a Simple Farm Engine.

BY F. G. WOODWARD.

The following additional details of the farm engine illustrated in the American Machinist, Volume III, Nos. 7 and 12, will be found of interest to the builders of this class of engines.

Figures 5 and 6 show the construction of the ball joint at the center of the guiding

Fig. 5.

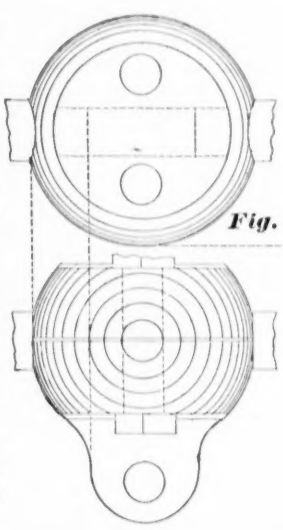
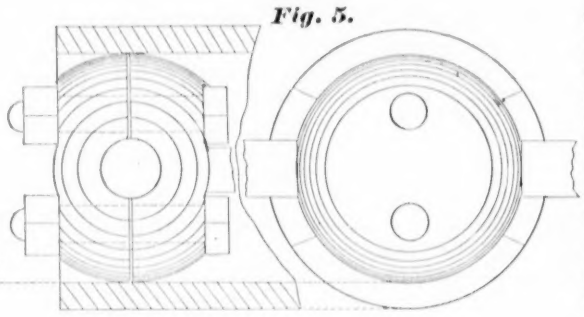


Fig. 6.



axle. The arrangement is clearly shown. The clamp that embraces the axle forms a portion of a sphere which fits easily into the socket, which is bolted to the boiler. The socket is prevented from lifting off the ball by a bolt jointed to the ball by an ear (seen projecting from the ball), the bolt entering the smoke arch with a nut on its end. Fig. 7 shows three views of the shoe which secures the spokes of the wheels to the steel tire. This shoe should be cast of

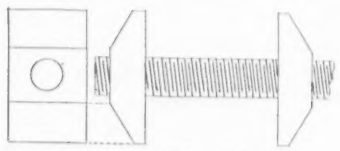


Fig. 10.

malleable iron or steel. Fig. 8 shows a plan and edge view of the eccentric and strap which is of the reverse description as illustrated in the American Machinist of January 3, page 4. In this case, however, the catch which holds the eccentric to its working position, consists of a steel pin which slides through the hub of the fly-wheel and enters the hole seen in the plan view, a portion being left above the face of the eccentric to prevent the pin from passing the hole when being reversed. Fig. 9 shows a plan of valve seat and ports, and Fig. 11 a plan and edge view of valve. Fig. 10 shows the method of attaching the valve stem to the valve. The stem enters the slot, shown in the edge view. Fig. 11 shows the nuts fitting snugly yet easily on the opposite edges of the valve.

It is important that all of these details should be made of stock of the finest grain and as hard as can be worked evenly on planer and lathe.

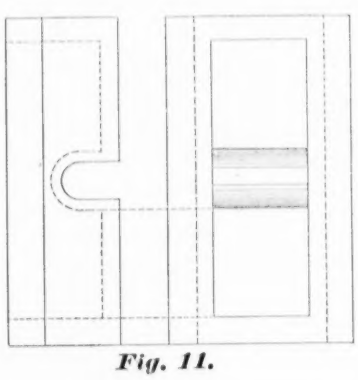


Fig. 11.

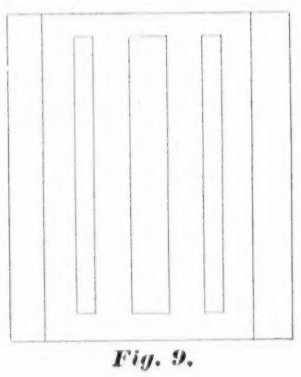


Fig. 9.

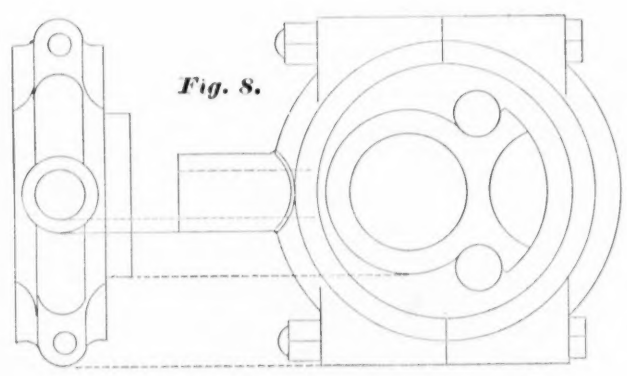


Fig. 8.

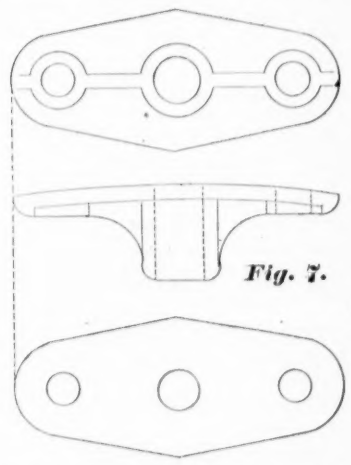


Fig. 7.

Gleanings from the Foreign Press.

COMPRESSED AIR LOCOMOTIVE.

Colonel Beaumont, M. P. for South Durham, says the *Ironmonger*, has invented and patented a compressed air locomotive capable of running ten miles without requiring replenishing, and drawing two loaded tramcars at a speed which can be easily regulated. At an experimental trial, the engine was started with a pressure of 900 lbs. to the inch in the reservoir, and when stopped in three-quarter's of an hour's time, 600 lbs. still remained. The revolutions per minute were 110, and the total number of revolutions was 4,730, which, if the engine had been running on a road would have been equal to over seven miles traversed.

THE IRONWORKERS OF ENGLAND.

The following, according to the *Universal Engineer*, is a classified list of the working population engaged in the various branches of the British iron manufacture: Hands employed in connection with blast furnaces or iron works, 140,000; hands engaged in the manufacture of steel, 5,500; founders, 88,690; nail makers, 23,000; locksmiths, 7,154; cutlers and blacksmiths, 39,000; mechanics, 169,000; hands employed in iron shipbuilding, 48,000; workmen engaged in various trades, 28,000. It thus appears that the number of people engaged in the iron trade amounts to about 570,000. This is somewhat greater than that of the mining population, which comprises 535,000 persons, and rather less than the total number engaged in the cotton manufacture, which employs 600,000 hands. These three chief industries of Great Britain thus give employment to upwards of 1,700,000 persons.

"WEAVING IN THE OLDEN TIME."

An interesting lecture with this title was given in Blackburn, by Mr. Roger Lightbown, says the *Textile Manufacturer*, to an audience of about 200 persons. The lecturer, referring to the probable condition of weaving before the Flood, said that the first kind of weaving was done entirely by hand, the grass used for weft being worked through the warp (also strips of grass) by the fingers, and he exhibited a piece of cloth of this material and manufacture, which was marvelously fine and evenly worked. Tradition, he said, ascribed the invention of looms to a relative of Tubal Cain, and history showed that immediately after the Flood they must have been got to such a perfection as to enable men to weave a garment large enough to cover the shoulders and bodies of two men. The first loom was doubtless nothing more than a frame on which the warp was fastened, whilst the woof was worked in with the fingers as before. The next stage was the enlargement of this frame into a sort of upright loom, on the same principle, the working of which was afterwards facilitated by the invention of beams or rollers, and of a shuttle—and still later by contrivances embracing, in a primitive fashion, the reed and slag of modern times. The history of Joseph mentioned a coat of many colors; and weaving was referred to in the book of Job; the curtains of the tabernacle in the wilderness, Samson's hair being woven into a web with a beam, and the garment of Christ woven without a seam from the top throughout, were evidences of the perfection to which weaving had attained; and there were indications in the book of Job that the art was far in advance of mere handloom weaving. Gilroy, who introduced the fork and grate into England in 1842, stated that when he started a power-loom mill in Egypt, he found a tradition existing amongst people about Assyrian weaving, and he asserted that the Assyrians had looms driven by compressed air, and actually used the fork and grate, which constitutes the self-stopping action of modern looms, and which, though mentioned in his book, published in 1842, was not introduced into Lancashire until two or three years later. The lecture was illustrated by models and drawings of various constructions of handlooms, the more primitive of which were made after the style pictured in the only illustrations of Egyptian weaving which have been handed down to us.

THE WORLD'S STEEL PRODUCTION.

The London *Times* says that the total capacity of the steel mills at the present time throughout the world is estimated at about 3,000,000 tons for the year's production. In the United Kingdom there are 120 Bessemer converters built, of which there are 80 at work, and the annual yield from these is estimated at from 755,000 to 800,000 tons. The American make is estimated at 750,000 tons, the next largest producer being Germany, which is considered by many to be capable of the greatest expansion among all the steel-making countries. Less than two years ago there were 25 converters in Prussia working out of the 50 built, and turning out 375,000 tons, which was increased by the works in Saxony and the Palatinate to 400,000; and since the revival of trade fresh converters have been put into operation. The estimate of the French steel manufacture is about 275,000 tons; that of Belgium, 150,000; of Austria, with 32 converters, 250,000; and of Sweden and Russia, 150,000. Looking at the probable extension of railways for the next 12 months it is difficult to see how all this large output of steel rails is to be utilized.

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NEW YORK, APRIL 10, 1880.

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In view of present developments, this would seem to be a good time to engage in the paper-making business. This will mean an increased demand for paper-making machinery and appliances.

Protection Against Steam Boiler Accidents.

We have repeatedly called attention in these columns to the unwise policy so often pursued by owners of steam boilers in engaging cheap and unreliable engineers to manage their steam apparatus. The amount saved in wages is likely to be lost ten times over in mismanagement, besides increased liability to accidents. There is, however, another phase of the question which demands attention, in behalf of competent and reliable engineers, who are often constrained to keep silence when they see plainly that danger exists, and can be obviated by an extra expense for new apparatus or for repairs. The extreme parsimony of some steam boiler owners frowns upon any recommendations from a capable engineer that involve extra expenditure, and the latter, fearing the loss of his situation, often keeps silence when impending danger would prompt him to give timely warning.

Careful periodical inspection of steam boilers by experts *under authority of law*, as well as the strict examining and licensing of engineers would, undoubtedly, afford a measure of security against carelessness in the use and management of steam machinery, either on the part of the owner or the person in immediate charge. In the enactment and enforcement of laws governing the use of steam boilers many serious mistakes have been made, resulting either in a repeal or entire neglect of the existence of such laws. But so long as the desirability of efficient laws regulating the employment of stationary steam machinery is recognized in every locality where boilers are numerous, the most earnest efforts of leading mechanical engineers should be directed towards their proper enactment.

It should, however, be borne in mind that no statute for the purpose of binding steam users will work satisfactorily unless its provisions are approved by at least a majority of the persons it is designed to affect. The overlooking of this fact has been the cause of failure of most of statutes for the regulation of boiler owners and managers. It would be idle to assume that there are any insurmountable obstacles to the enforcement of wholesome laws against the employment of unsafe steam apparatus and unqualified engineers. Popular attention should be directed to this object by the technical press.

The U. S. Government regulations for marine boilers, engines and engineers are universally recognized as a safeguard against accidents that could not well be dispensed with even though an occasional official neglect of duty is exposed. State or municipal regulations covering stationary steam apparatus could be made to work fully as well if not better.

The collection of accurate statistics of casualties, losses on property and insurance, is almost impossible, but approximate data is often gathered which is of the greatest interest to the public at large. A correspondent of the *Chicago Inter-Ocean*, sends to that journal the following steam boiler statistics for 1879:

Number of explosions	627
Number of persons instantly killed	794
Number of persons injured	2,094
Loss	$6,373,235
Insurance (known of)	2,537,000

In sending this compilation to that paper, the compiler says: "As a rule, steam boilers are inspected by men sent out by the underwriters, if by no one else. I have come to the conclusion that the fault is not so much with the boilers as with those in charge of them. I see your paper recommends government control and examination of locomotive engineers so that none but competent men, and men of good habits, shall be employed as engineers on the railroads of the country. This is an excellent suggestion. I would also suggest that some system of inspection, city or State, be adopted in regard to stationary engineers. Every man employed in such a position ought to be compelled to show a certificate from some city or State board that he is competent and of sober habits. The State of Illinois and every other State ought to have a board for the examination of engineers. Certainly the matter is of sufficient importance to warrant such a board."

It is also stated, in the same issue of the *Inter-Ocean*, from which we extract the above, that "most of the engines in the business and office blocks in the city (Chicago), are in charge of old, feeble men, or mere boys, and there are actually cases where women do the work. In some places, too, the engineer does not put in his whole time about the engine and boiler, but is called out by the foreman every now and then to do other work, and the engine and boiler have to take care of themselves for long periods." Precisely the same condition of affairs, as above described, exists in the city of New York, and that there are not more disastrous boiler explosions is not owing to the precautions taken to prevent them, but rather to good fortune.

Both insurance companies and the public at large should unite in demanding action by State and city authorities.

Co-Operation Among Engineers.

It may be of interest, in view of the complete organization of the new American Society of Mechanical Engineers, which is to take place April 7th next, at the Stevens Institute, Hoboken, to recall an important service which that body may hold itself in readiness to perform for every mechanical engineer on its list of membership.

Every sensible person recognizes the value of making provision in good times for the evil day, which, sooner or later, is liable to come to every man. The man who buys his umbrella on a clear day is the only wise man. The man who never thinks of buying umbrella or waterproof till the rain pours down in bucketfuls, is either a very careless or a very unwise man. The engineer, however prosperously or permanently placed, who leaves the possibility of future contingencies wholly out of his calculations, may live to regret his shortsightedness.

Actuated by such considerations, the American Institute of Mining Engineers have set an example which the Mechanical Engineers may follow with profit:

The Secretary of the Institute was authorized by the Council at the Montreal meeting, September, 1879, to act as employment-agent for members and associates of the Institute. Those wishing to obtain employment may send their names to the Secretary, stating the kind of position desired and giving a brief account of previous experience. Any one wishing the services of a mining engineer, metallurgist, geologist, chemist, etc., may apply to the Secretary, who will send him the names on the lists corresponding to the position which it is desired to fill. It must be understood that the Secretary's functions are purely formal, and that no indorsement or recommendation is implied when names are communicated to employers. The fitness for a position must be subsequently ascertained from the applicant himself. There are no fees or charges connected with this service.

The wide field covered by the new Society of Mechanical Engineers, and the wide range which its membership is likely to take, including practical manufacturers in every branch of business, master mechanics of railways, and chief engineers of steamship lines, as well as designing and consulting engineers, mining and civil, military and naval engineers, teachers and trustees of technical schools (and many other influential and valuable members, whose exact status cannot be easily defined in general terms), would tend to render such a feature in its organization especially valuable. It would, in effect, be an *insurance clause*, applying to employment, instead of life or property.

Eccentricities of Employers.

Much has been said in reference to the extreme views which are often taken by mechanics generally, but there are certain events which occur in practice, concerning which very little has been said. There are, usually, in most shops, a certain few mechanics who enjoy the sympathy and smiles of the proprietors. They are, perhaps, very fair workmen, but more frequently are unable to do a piece of fine work, and possess few, if any, qualifications to entitle them to the approbation of their employers. Another class of mechanics may be found in the same shop who are thorough gentlemen; *i.e.*, they are strictly moral in their habits and deportment, are always punctually at their work, and circulate in good society.

These men can generally do any respectable job that is required. In the evening, after the duties of the day are over, these men may be found either at their homes reading some useful publications or studying up matter which pertains to their business. If the evening is spent away from home, it is at some lecture, place of amusement or in other associations which have a tendency to elevate men to a higher standing in the community.

When pay day comes one or more of the class of men first referred to, will "take a day or two off," at the expiration of which time they come back, and are summoned to the office. When asked to give an account of themselves, one states that he has been "very sick," while another has buried an "uncle" or an "aunt." The latter must belong to the familyof "Smith" otherwise he would not have enough relations to furnish him with a funeral every pay-day. The employers look gravely on at this mock trial, and after it is finished express their sympathy for the unfortunate men, who are then allowed to go to work. In one instance these transactions were so often repeated that the employer used to accost a certain man upon his return to the shop with these words; "Well, Sam, you were pretty sick this time, were you not?" while "Sam," looking very grave, says: "Yes, I came very near going this time." To the other he will say: "Well, Joe, are not all your relations buried yet?" or "whom are you going to bury next?" While this farce is being played between the employer and these workmen, the steady and reliable man sometimes desires permission to use a day for urgent business and is met either with a flat refusal, or if the privilege is allowed it is with some comments which have the effect of injuring the feelings of the man, and to cause him to feel very uncomfortable.

If the improvident workman wishes a few dollars before pay-day to "buy a new coat" (an expression which is well understood) the employer often hands out the money at once with the admonition, "don't spend this for whiskey." If our respectable friend sees a chance to buy any article at a bargain and wants a few dollars in advance he is frequently met in a very different spirit from the other man. The improvident man sometimes gets the best wages paid in the shop, and when our intelligent workman wants his wages advanced to the same amount he may be told that it can't be done, as the former is an old hand, which is the only reason for his receiving better pay, while the employer admits that the latter does more and better work.

Some employers are so peculiar in this direction that they will allow the best workman to leave the shop, because they think it bad policy to pay him the same wages as the older hands.

An employer, if he understands his own interest and desires to secure the best results, will respect and favor a workman according to his qualifications. If he is a new hand and proves worthy he should be paid according to his value.

It is best to pay workmen only on pay-day. A poor and unsteady workman is extravagant at any price and will be a constant damage to a concern. The judicious employer engages only respectable persons, and treats them as men and realizes the benefits to be derived from this course in numerous ways.

The New England Manufacturers' and Mechanics' Institute.

We called attention to this organization last summer, taking occasion to commend its purpose, which is to hold a fair or exhibition every Autumn at which the various industries of New England shall be represented, any profits arising therefrom being devoted to the interests of industrial education. The gentlemen interested in this movement are prominent men, and the progress thus far made towards its organization indicates complete success. Subscriptions to the amount of $50,000 have thus far been

taken. Shares are $25 par value, and subscribers are limited to four shares. Parties desiring to become stockholders may obtain further information of R. C. Graves, 29 Oliver street, Boston.

A Trade Union Demolished.

Our readers will bear witness that the AMERICAN MACHINIST has always taken strong grounds against the operation of trades unions designed to establish certain uniform rates of wages among workmen. It matters little whether these unions are composed of employers or workmen, the principle is the same. The men employed in piano making in New York city have, for some time, maintained a union which the manufactures declared inimical to their business. In order, as the latter asserted, to break up their employes union, *they themselves formed a union* to enforce a certain control over the necessities of their men. The first movement of the new association was to give notice of a general lock-out of their workmen, until those on strike in one particular piano factory should return to work upon any terms the proprietors chose to demand. Here they made a huge mistake. It was an open declaration of a general war upon employes. In less than ten days from the beginning of the lock-out, one "black sheep" after another appeared in the manufacturers' fold, until the whole union went to pieces ingloriously. The workmen were taken back upon the terms they had contended for, many of them at increased wages.

The moral is obvious: If trade unions are bad for workmen, they are also bad for manufacturers.

Railway Cars for Summer Travel.

The scope of the mechanical engineering art is so wide that few of us realize the extent of our dependence upon it in our pleasure-seeking as well as business uses. The able engineer, Mr. Herman T. C. Kraus, of 34 Park Row, New York, to whom our readers have been indebted for a number of excellent articles (one appearing in the present issue) has illustrated the versatile nature of the engineer's art, in the design of a new "Summer Car" for railway use during the heated term which is approaching. It is admirably adapted, not only for transit to and from such summer resorts as Coney Island and Long Branch, but also for elevated railways and suburban travel.

The body of the car is 40 feet long by 8½ feet wide, outside measurement. There are 56 side seats, as in any other car of the same size; there are in addition 10 double seats in the center of the car, making 76 seats in all. There are 26 windows, with a clear opening of 33x36 inches. Behind the seat is attached a device, by means of which the window sash is balanced at any desired height, without being affected by the movements of the car.

The doors are in two equal parts or sections, the total opening of door being 40″ wide and 6½ feet high. By an ingenious but simple device, moving either half of the door causes both halves to slide into the casing. Care has been taken in the design to secure without trouble free access to each of these devices. The double seats in the center of the car are made to fold automatically when not occupied. The window sashes are merely a shutter (or shade) with a single glass, 12″x12″, in the center. The body of the car is intended to be painted white or some suitable color on the outside. Letters 24″ high, representing the name of the railroad, may run the whole length of the car, if desired, under the windows. These letters should be gold, nicely shaded, and surrounded by leaves and ornaments, to render the outside appearance of the car pleasing to the eye of the pleasure-seeking public. No well-regulated user of railway cars can afford to slight the advantages which a neat and tasteful exterior afford in making their passengers believe that they are having a good time.

Cars built after this design are now in process of construction for one of the lines running to Coney Island, enabling an appreciative public to enjoy their benefits throughout the coming summer.

The drawing of 100 H.P. engine bed in our issue of March 27th should have been marked, "Scale ¾″ = one foot" instead of 1½″= one foot.

LITERARY NOTES.

GRIMSHAW ON SAWS. History, Development and Action; Classification and Comparison; Manufacture, Care, and Use, of Saws of all Kinds. Quarto. Cloth. Over 180 Illustrations. $2.50. By Robert Grimshaw. Published by Claxton, Remsen & Haffelfinger, Philadelphia.

This very handsomely bound, and profusely illustrated volume is written in pleasing style, and contains much valuable information upon an important, but hitherto neglected subject. The book relates to the use of every kind of saw, and deserves careful perusal and filing for reference. Information is contained in the appendices (which occupy over 50 of the 160 pages) which will be especially useful to many readers. It is copiously indexed, and contains a complete list of all U. S. Patents on Saws from 1790 to 1880. We can commend this book heartily.

The Railway Age Monthly and Railway Service Magazine is a new and valuable addition to railway literature, which commenced publication with the year 1880. Every number contains at least 64 pages of the usual magazine size, well printed and illustrated. The numerous railroad employes, for whom it is especially designed, will be able to derive much instruction and entertainment from the perusal of this excellent periodical. Subscription $1.50 a year. Address the Railway Age, Chicago, Ill.

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James W. See, Consulting Engineer, Hamilton, Ohio.

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See Standard Turbine advertisement in late number.

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Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, 65 Henry Street, Brooklyn, N. Y.

Car Builders' Dictionary. Now ready. Assigns names to kinds and parts of railroad cars, identifying each. 800 engravings, and 490 pages. Price, postage prepaid, $4. Ten copies to one address, $17.50. Published by the *Railroad Gazette*, 73 Broadway, New York.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

To Manufacturers.—We are prepared to furnish Recipes and Information on all Industrial Processes. Address Park Benjamin's Scientific Expert Office, 37 Park Row, New York.

John Fish, M. E., Room 23, 8 & 10 Pine Street, New York. Special attention given to Designing and Superintending the Construction of Improved Machinery. Hoisting Engines, Air Compressors, and Pneumatic Motors a Specialty. Working Drawings and Plans, Specifications and Estimates furnished.

Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. F., Burlington, Vt., asks: What is the rule by which to ascertain the actual H P transmitted by a shaft? The device that I wish to make use of is the application of a plain weighted lever of wood, which is attached to the shaft by a wooden clamp. I believe the apparatus is called a lever dynamometer. *A.*—Multiply the length of the lever in feet (that is from the center of the shaft to the center of the weight), by the number of revolutions of the shaft per minute, and that product by the weight applied at the end of the lever in pounds, including the weight of the scale (we take it for granted that the customary scale is used to indicate the weight applied), and finally by the decimal .0001904, which will give the H P required. Let L=length of lever in feet, and N=number of revolutions of shaft per minute, and W=weight applied to the lever in pounds, including the weight of the scale, then the actual H P will be $.0001904 \times W \times L \times N$.

(2) J. R., Brooklyn, N. Y., writes: 1. I am an apprentice at the machinist trade and would like to advance myself. I would like to get some good book on running steam-engines. What book would you recommend? *A.*—The Hand-Book of Land and Marine Engines, by Stephen Roper, is the best practical work that we have seen for young machinists. 2. Do you think chewing tobacco is bad for an apprentice? Which is the worst, chewing or smoking? I have been doing both, and contemplate giving up one or both, just as you say. What are the effects of tobacco? *A.*—We answer emphatically, *both* in all cases. It is difficult to decide in reference to health as to which is the worst, viz., chewing or smoking, for they are both bad enough. The use of tobacco seriously interferes with the action of the heart, and it is stated by physicians that a large portion of the cases of heart disease are traceable directly to the use of tobacco. It poisons the whole system, and absorbs too much loose change. We advise you to give up both chewing and smoking if you wish to have a clear and healthy brain, and to spend the money tobacco would cost for good and useful books and papers.

(3) J. P. L., Birmingham, Conn., asks: Will you please tell me a rule that will give me the horse-power of the teeth on any sized wheel? *A.*—Multiply the pressure at the pitch-line by its velocity in feet per minute, and divide the product by 33,000. Example: The pressure of a certain wheel at the pitch-line is 4886 lbs., the velocity is 6.06 feet per second, then the formula would be thus $\frac{4886 \times 6.06 \times 6^2}{33{,}000} = 59.16$ horse power. 2. How can I find the horse power of a belt? *A.*—The rule in general use says that a belt 1″ wide and running at a velocity of 1000 feet per minute is equivalent to a H.P., but this is only an approximation. Samuel Webber, who has been engaged for a number of years past in measuring power, says that the following rule, which was given him many years since by an experienced mechanic, is perfectly reliable: Ordinary leather belting one inch wide, having a velocity of 600 feet per minute will transmit one horse-power. Example: A belt 12″ wide has a velocity of 2400 feet per minute: required the H.P. $\frac{2400}{600} = 4 \times 12 = 48$ H.P.

For full description of belting, see paper on Transmission of Motion in the AMERICAN MACHINIST for March, 1878, by Chas. E. Emery, C. E.

(4) C. F. D., Galveston, Texas, asks: What is the rule for making open end wrenches, to withstand the power applied to wrench when using? *A.*—We are not aware of the existence of any rule that will answer your query. There are many conditions which would have to be considered in order to get at a definite result.

MANUFACTURES.

It is stated that the water works question at Joliet, Ill., has been about settled, with fair prospects of the city having the improvement at an early day.

The town of Gardiner, Mass., is seriously agitating the question of constructing water works.

D. Mackintosh & Son, Holyoke, Mass., have raised the wages of employees ten per cent.

In a recent visit to Holyoke, Mass., we noticed great activity in the shops of the Holyoke Machine Co., building paper-making, and mining machinery, and turbine water wheels. They are making a considerable enlargement to their iron foundry, and are putting in new tools. All the machinery in their extensive shops is of the latest and most improved patterns.

Chicago is to have a new Glucose factory, a company being organized to build it with a paid up capital of $650,000. Of this amount Mattheison & Weichers, sugar refiners, invest over one-half, and Cyrus H. McCormick $75,000. The capacity per day is to be 20,000 bushels of corn. A bushel of corn costing 40 cents produces 30 lbs. of grape sugar or three gallons of syrup. The sugar sells in quantities at 3½ or 4 cents a pound, and the syrup from 35 to 40 cents a gallon.

Marlboro', Mass., a town of about 10,000 inhabitants, is talking of constructing water works.

It is the intention of the Allen Car Wheel Co., to establish a manufactory in Chicago, but the location at present, if known, has not been made public.

A large tract of ground in Chicago, has been recently sold to some Philadelphia parties, who intend to erect extensive steel works thereon.

The machine shops of Stokes & Parrish, Philadelphia, are to be extended, their present capacity being unequal to the demand for their work.

The Secretary of State, of Illinois, has just issued licenses to organize the following proposed corporations: Austin Rotary Plow Co., Chicago; capital, $500,000; corporators, John Austin, J. J. Hall, S. Park Coon, H. H. Armstead; the Chicago Sugar Co.; capital, $150,000; corporators, John E. Ransom, J. Albert Ellis, George W. Colhan.

Gloucester, Mass., is in want of a water supply, and is considering the sources of supply, cost of introduction, and probable income.

The W. H. Rogers, Jr., Clock and Model Works, which were formerly located at 96 Fulton Street, N. Y., have removed to 119, on the same street. The concern mentioned is engaged in the manufacture of many kinds of clocks and clock movements for special purposes, also models and experimental machinery. The cutting of very small gears is made a specialty, and with the facilities in Mr. Rogers' possession enable him to cut any number of teeth on small gears of any diameter, such as are usually required in the class of machinery referred to.

The American Writing Machine Co. are fitting up a factory with new tools and appliances on 31st Street, near 7th Avenue, New York City, which will have a capacity to produce 100 type-writing machines a day.

John Bayliss, 159 East 54th St., New York, inventor and manufacturer of an improved tuyere and bellows, is to remove and enlarge his concern next May, and devote his entire time and attention to his hot water tuyere and his "hurricane" bellows for smiths' use, his orders having come in so fast as to make an increase of facilities necessary.

T. P. Osborne, a student of Yale College, New Haven, is said to have invented a way of bolting flour by the application of electricity, which has been patented, and for which he has been offered quite a sum of money.

The manufacture of sporting implements, on account of the gaining popularity of outdoor sports, is becoming a flourishing industry in this country. It is estimated that between 50,000 and 60,000 sets of croquet, and 200,000 base-ball bats and 250,000 base balls will be made for this season's trade by one firm in Chicago.

The capital stock ($50,000) is being subscribed for a new jute mill to be built at New Orleans, La. Bagging for cotton bales is to be manufactured. A strong effort is being made to introduce the culture of jute into Louisiana.

The street car companies throughout the country using "bobtail cars" have hitherto paid a royalty for using the money boxes to John D. Slawson of New Orleans, who is reported to have made $1,000,000 by his patents on these boxes. But a United States Judge in Brooklyn has now decided that the patents are void, the device described having been in use years before the issuing of the patent.

Following figures show to what a marked extent within recent years iron has superseded wood in the building of ships in England. In 1850, 12,000 tons of iron ships were made; in 1860, 64,699 tons; in 1870, 272,000 tons of iron ships against 100,000 tons of wood; in 1878, 400,000 tons of iron ships, and scarcely any wooden ships, were constructed.

Over 43 per cent. of the woolen machinery in the United States stands in New England. Massachusetts contains 1,418 sets of woolen machinery, Connecticut 669, New Hampshire 505, Rhode Island 469, Maine 331, and Vermont 175. The whole number of sets in the Union equals 8,431.

The gross earnings of about forty of the principal railroads in the United States for January of this year were $12,842,163, an increase of $2,715,092 over January, 1879.

Machinists' and Engineers' Supplies.

New York, March 25, 1880.

The supply market this week continues rather quiet, which may be accounted for by the fact that for the past two months things have been booming. Now, since goods are a little easier to obtain, dealers are not so anxious to secure a stock, as prices are expected to decline a little.

The prices of rubber goods, such as packing, hose and belting, remain unchanged with a steady demand.

Leather belting, although unchanged in price, is stiffening.

The demand for brass and copper goods continues, and the manufacturers still have orders for several months ahead.

The manufacturers of machine screws are now able to supply the demand.

Orders for steel-forged goods are now filled without difficulty.

Drop forgings of lathe dogs and wrenches are obtained with difficulty, likewise taps and dies, as the demand continues and the manufacturers are still behind.

The best cop waste is advancing slightly, and continues scarce. This is caused by the successful attempts of the manufacturers to prevent the formation of waste in the manufacture of cloth.

By mistake in the advertisement of the Peerless Damper Regulator, the price was made to read $38.50, where it should be $75.00.

The American Steam Gauge Co., 36 Chardon street, Boston, Mass, have just issued a new illustrated pamphlet containing 16 pages.

This pamphlet explains the Thompson Indicator, Amsler's Polar Planimeter, and the Pantograph. Extracts from Chordal's Letters, which appeared in the American Machinist of Dec. 20th and 27th, 1879, describing each of these instruments are re-published in ull.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of March 25, 1880:

Metals, generally, very quiet; the volume of business small. Pig Tin has declined in London to £85, and in Singapore, to $29¼; this Market entirely nominal; Spot, Banca Tin, 24c.; Malacca & Straits, 21¾ to ½c.; Billiton, Australian and English Refined, 21c.; "Lamb & Flag," 21c. Pig Lead, since our last, declined ¼c. per lb., but has recovered in part, and now quoted 5¾c.; Antimony, Cookson, extremly scarce, 24c. and up; other brands, 19 to 20c.; Spelter, 6¾c.; Domestic and Silesian Ingot Copper, 23c., Nickel, $1.25. No. 1 Solder, 12c.; "Half-and-half," 14c.

Iron Review.

New York, March 25, 1880.

There are few if any indications of a perceptible change in the market at present, and it continues in favor of buyers.

The demand is good and the mills are catching up with their contracts.

Pierson & Co., 24 Broadway, N. Y., under date of March 25th, 1880, quote prices out of store as follows:

No. 1, X Pig, $41 per ton; Iron Rails, $68 to $70, according to weight; Old Rails $41 to $42; Fish Plates, 4c. per lb.; Railway Spikes, 4¾c.; Bolts and Nuts, 5½c.; Common Bar Iron, 3 7-10c., basis from store; Refined, 4c., basis; Ulster, 5¼c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 5c., basis; Angle Iron, 4 3-10c.; Tee Iron, 4 3-10c; Band Iron, 4 7-10c.; Hoop Iron, 4 3-10c., and up according to size; Horse Shoe Iron, 4 7-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers, 10% off in bulk.

Boiler-makers supplies: Flange, 6¼c.; C. H. No. 1 Shell, 5¼c., C. No. 1, 4¾c.; Sheets, 4¼c. basis; Boiler Tubes, 5 and 5% discount.

WANTED.

Two first-class machinists, who have run a job on all kinds of machine tools, one a planer and one a general workman, would like to take a large job together. None need answer, unless willing to pay the highest price for good men. Reference furnished for character and ability, if required. T. B. Box 80, Worcester, Mass.

Wanted to correspond with parties in need of a first class mechanic and draughtsman, who can design and construct modern steam power, mill work and special tools. Could act as foreman in machine shop and set up work in case of emergency. Address J. S., care American Machinist, 96 Fulton St., New York.

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Recent practice in the Combustion and Economy of Fuel: Coal, Coke, Wood, Peat, Petroleum, etc.
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Engine Lathes and Planers.
Ready for delivery in from 4 to 8 weeks. Sixty lathes from 13 to 20 in. swing. Five Iron Planers, 24 in. x 6 ft. These are all NEW TOOLS with LATEST IMPROVEMENTS built to our order at the very best New England shops. Send for prices, &c., to
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The Workshop Companion.
A handy and useful dictionary of practical information for Engineers, Machinists, Draughtsmen and Mechanics, containing useful and reliable recipes, rules, processes, methods, practical hints, &c. NO medical or cookery recipes. 164 pages. This book will be sent, post-paid, on receipt of Twelve 3-cent postage stamps.
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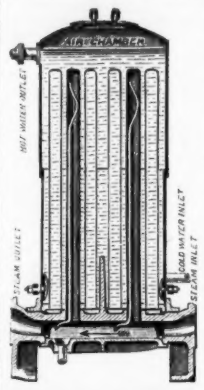

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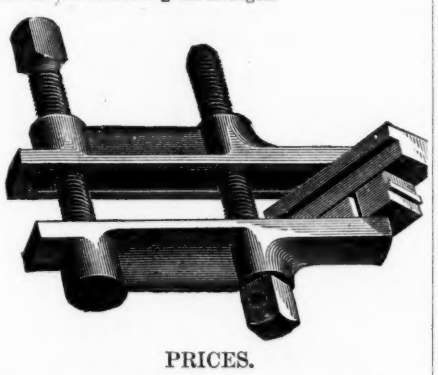

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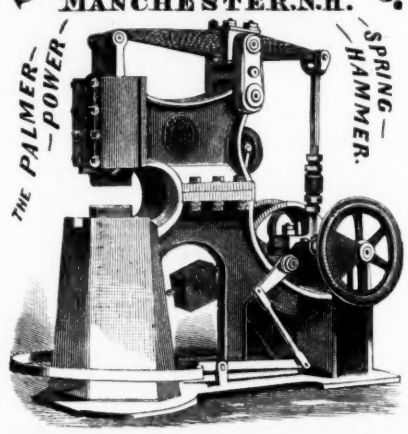

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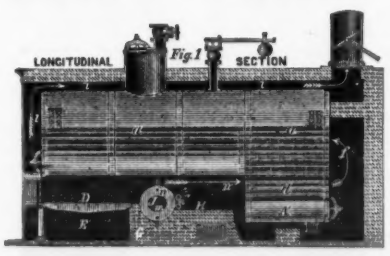

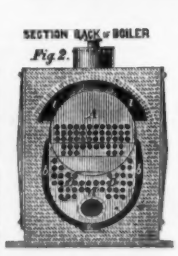

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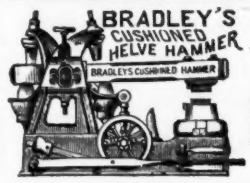

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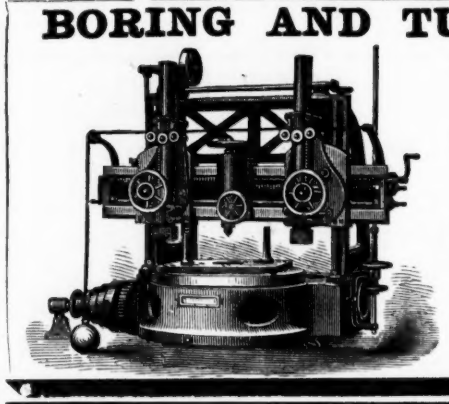

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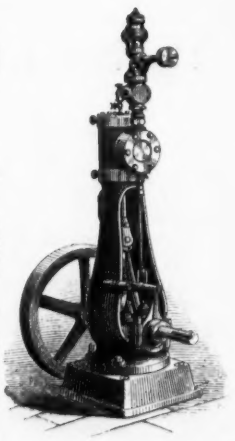

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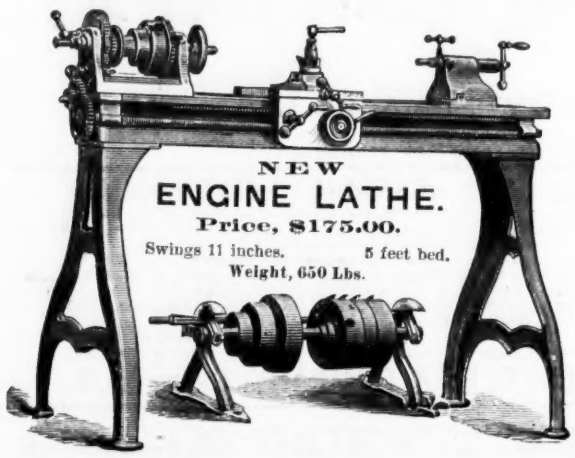

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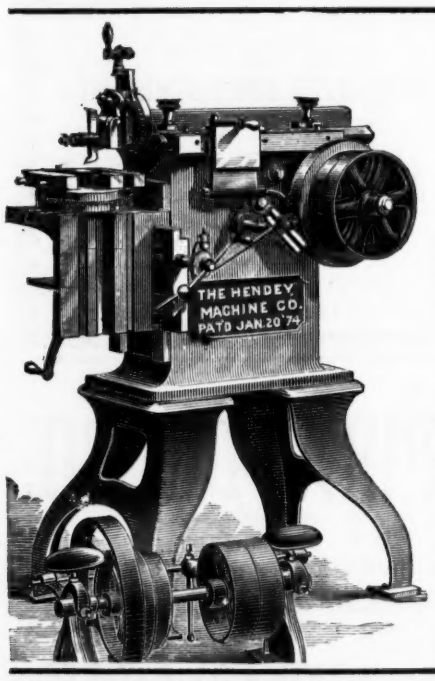

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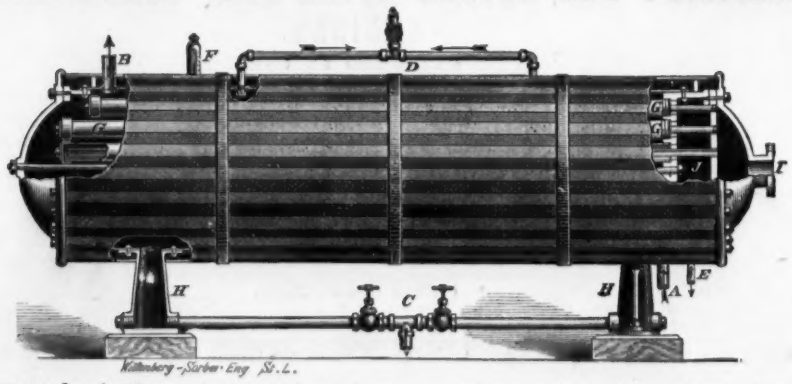

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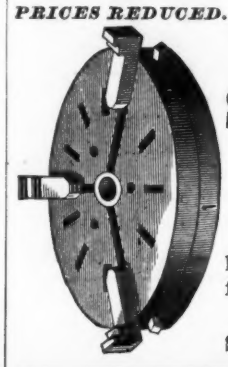

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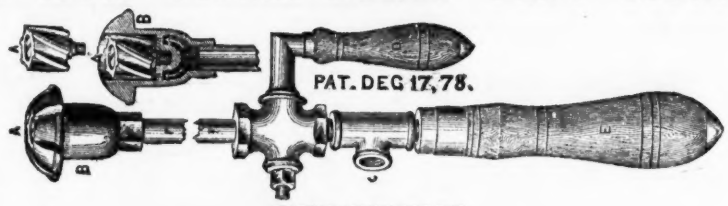

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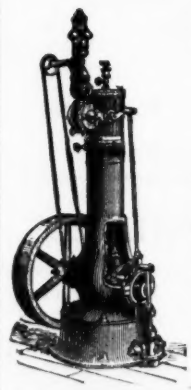

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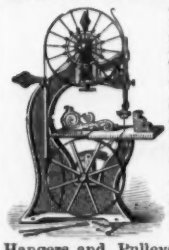

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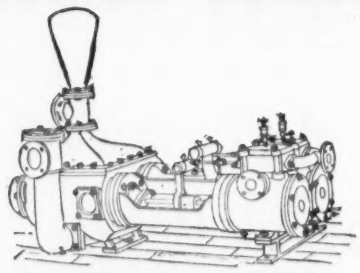

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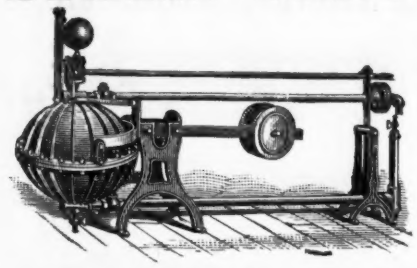

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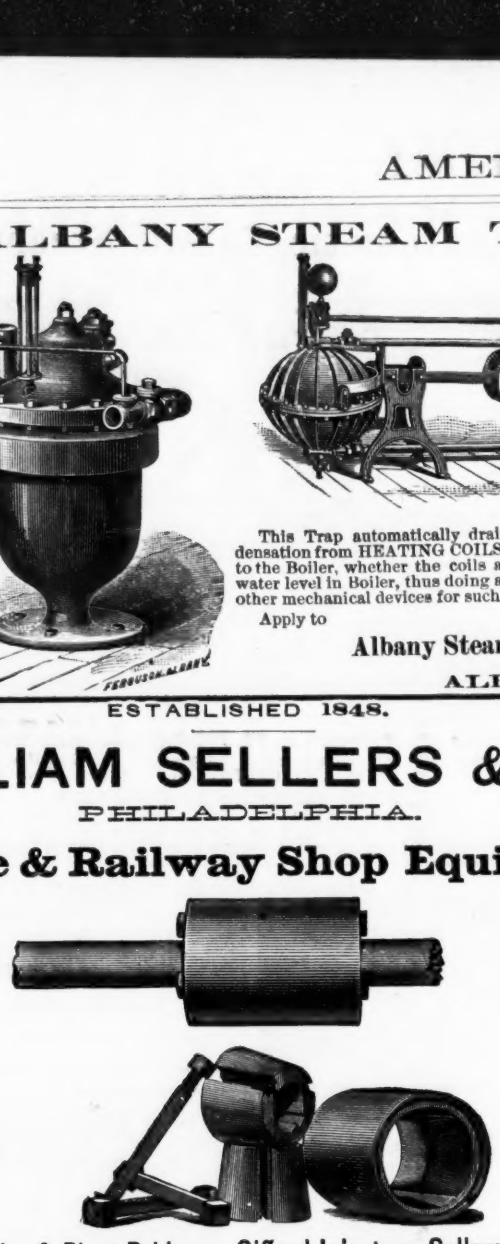

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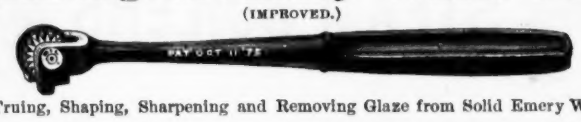

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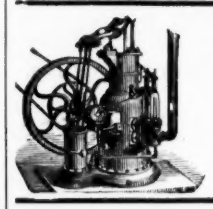

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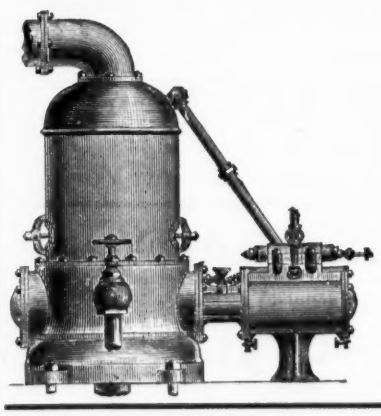

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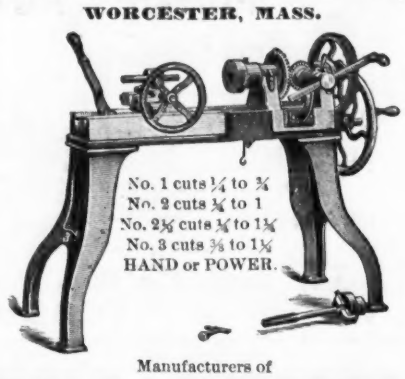

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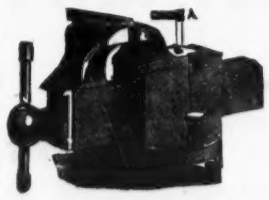

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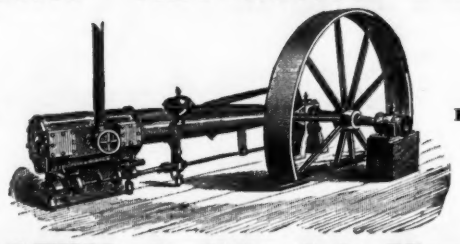

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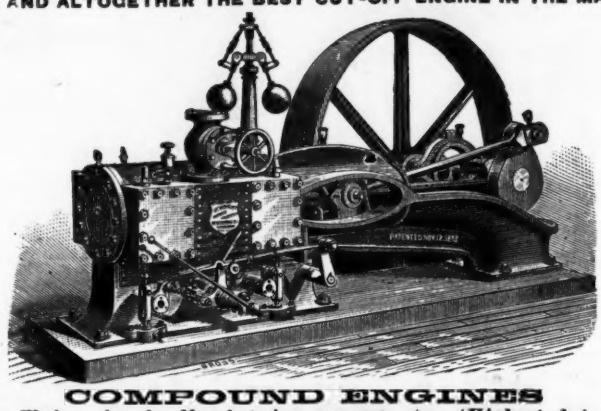

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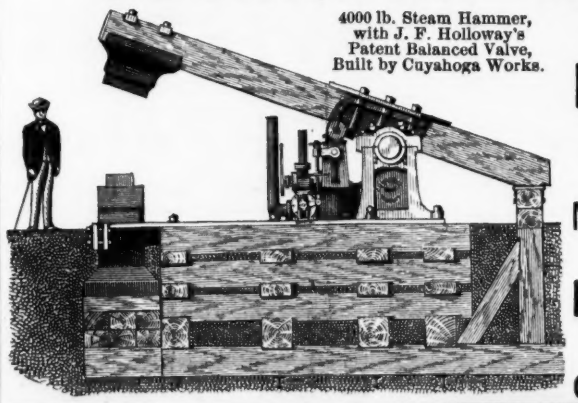

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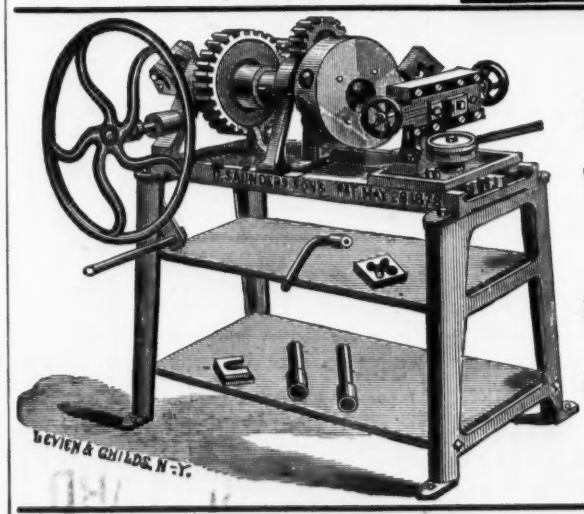

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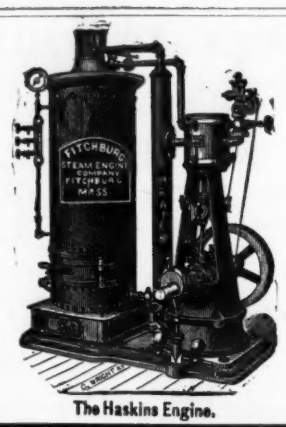

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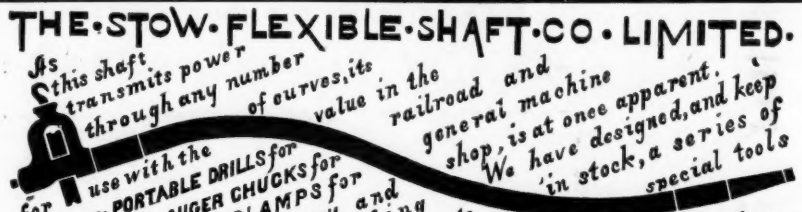
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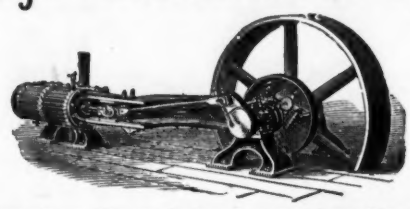

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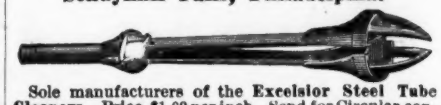

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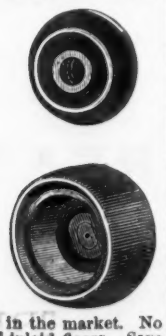

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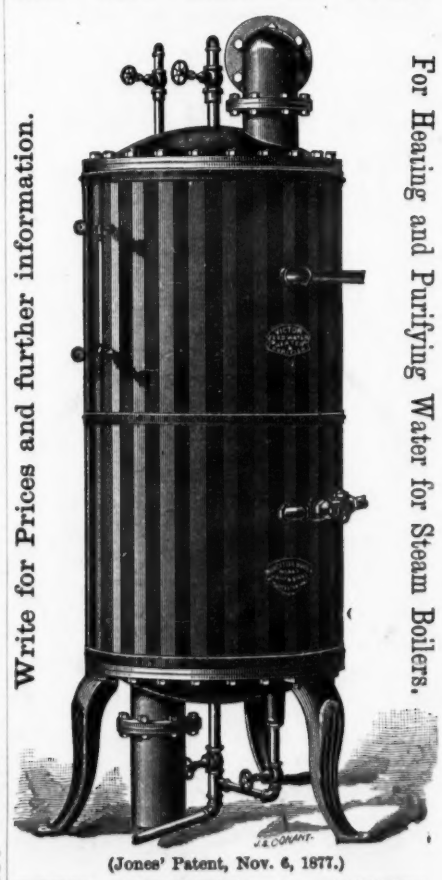

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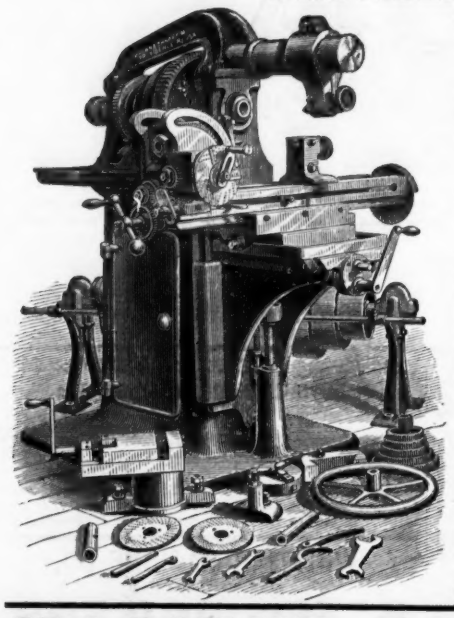

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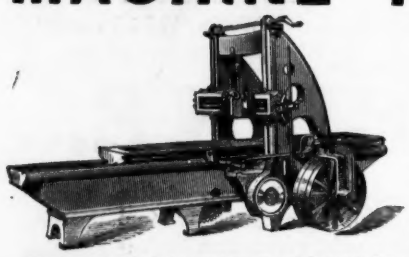

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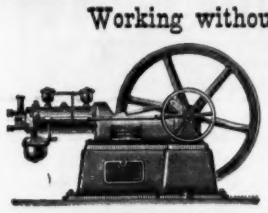

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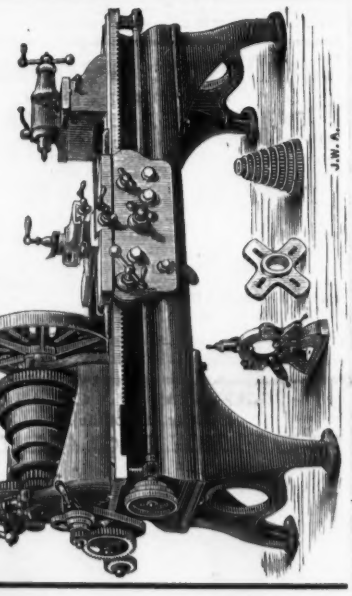

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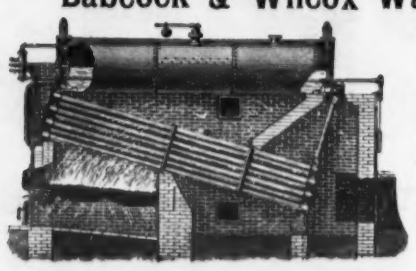

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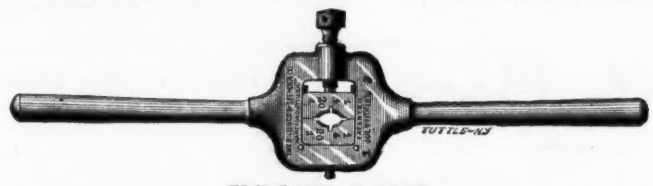

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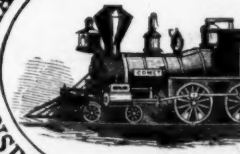

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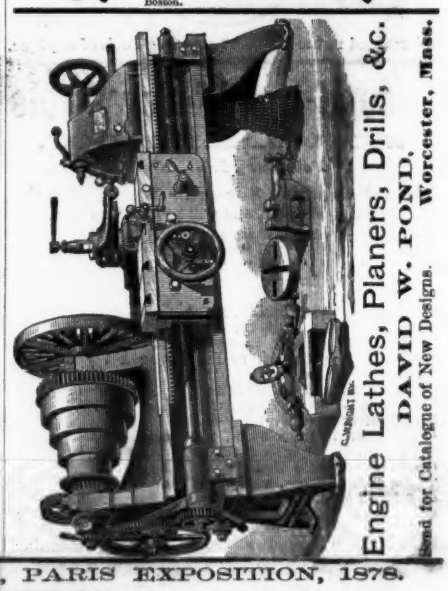

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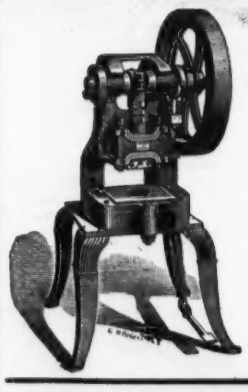

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